

(19)日本国特許庁(JP)

(12)公開特許公報(A)

(11)特許出願公開番号

特開平6-275366

(43)公開日 平成6年(1994)9月30日

(51)IntCl.⁵

H01T 19/04

識別記号

庁内整理番号

7509-5G

FI

技術表示箇所

審査請求 未請求 請求項の数14 FD (全 18 頁)

(21)出願番号 特願平5-88172

(22)出願日 平成5年(1993)3月22日

(71)出願人 000169499

高砂熱学工業株式会社

東京都千代田区神田駿河台4丁目2番地8

(72)発明者 佐藤 克己

神奈川県川崎市多摩区西生田3-20-9高

砂熱学工業生田寮内

(72)発明者 阪田 総一郎

神奈川県横浜市緑区鶴志田町807-43

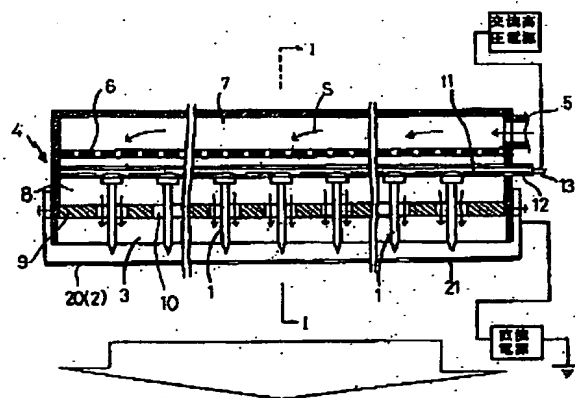
(74)代理人 弁理士 金本 哲男 (外2名)

(54)【発明の名称】 帯電物品の中和装置

(57)【要約】

【目的】 徐電効率を損なうことなく送風量を大幅に軽減可能な帯電物品の中和装置を提供する。

【構成】 送気源に接続され、かつカーテン気流形成用スリット状開口部(3)を有した送気チャンバ(4)と、高圧電源に接続されたコロナ放電用の複数本の放電極(1)からなり、その放電極が上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されて成る帯電物品の中和装置において、上記開口部をスペーサ(9)によりスリットの長手方向に沿って所定間隔で区画して複数の気流吹出口(10)に分割し、その各気流吹出口に上記各放電極をそれぞれ配してなることを特徴とする、帯電物品の中和装置である。本装置によれば、スペーサの占める分だけ開口面積が減少するので送風量を軽減可能である。



【特許請求の範囲】

【請求項1】送気源に接続され、かつカーテン気流形成用スリット状開口部を有した送気チャンバと、高压電源に接続されたコロナ放電用の複数本の放電極からなり、その放電極が上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されて成る帯電物品の中和装置において、

上記開口部をスペーサによりスリットの長手方向に沿って所定間隔で区画して複数の気流吹出口に分割し、その各気流吹出口に1または2以上の上記各放電極をそれぞれ配してなることを特徴とする、帯電物品の中和装置。

【請求項2】送気源に接続され、かつカーテン気流形成用スリット状開口部を有した送気チャンバと、高压電源に接続されたコロナ放電用の複数本の放電極からなり、その放電極が上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されて成る帯電物品の中和装置において、

上記送気チャンバを筒状に形成し、上記カーテン気流形成用の複数のスリット状開口部を上記筒状の送気チャンバのチャンバ軸の周りに放射状に設けたことを特徴とする帯電物品の中和装置。

【請求項3】上記各開口部をスペーサによりスリットの長手方向に沿って所定間隔で区画して複数の気流吹出口に分割し、その各気流吹出口に1または2以上の上記各放電極をそれぞれ配してなることを特徴とする、請求項2に記載の帯電物品の中和装置。

【請求項4】上記気流吹出口に取り付けられる放電極の本数が可変であることを特徴とする、請求項1または3に記載の帯電物品の中和装置。

【請求項5】上記各放電極は、金属製の針状電極を絶縁材で被覆してあることを特徴とする、請求項1、2、3または4のいずれかに記載の帯電物品の中和装置。

【請求項6】上記各放電極は、筒状の送気チャンバ内にチャンバ軸に沿って配線された1または2以上の被覆リード線にその一端が着脱自在に接続されていることを特徴とする、請求項1、2、3、4または5のいずれかに記載の帯電物品の中和装置。

【請求項7】上記各放電極は上記筒状の送気チャンバ内にチャンバ軸に沿って配線された被覆リード線の周りに放射線状に配列され、かつその一端が上記被覆リード線と着脱自在に接続され、さらに、上記放電極はチャンバ軸の周りに放射状に設けられた複数の上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されていることを特徴とする、請求項2、3、4、5または6のいずれかに記載の帯電物品の中和装置。

【請求項8】上記各放電極は上記筒状の送気チャンバ内にチャンバ軸に平行になるように配線された複数の被覆リード線に直交し、かつ放電極同士は互いに平行となるように配列され、かつ各放電極の一端は被覆リード線と着脱自在に接続され、上記放電極はチャンバ軸の周りに

放射状に設けられた複数のスリット状開口部にスリットの長手方向に沿って所定間隔で連設されていることを特徴とする、請求項2、3、5または6のいずれかに記載の帯電物品の中和装置。

【請求項9】さらに、上記各放電極から所定の間隔を開けて配置されかつ接地または直流電源に接続された対向電極が設置され、その対向電極がスリット状開口部の内部または外部に取り付けられていることを特徴とする、請求項1、2、3、4、5、6または7のいずれかに記載の帯電物品の中和装置。

【請求項10】各放電極から所定の間隔を開けて設置された上記対向電極の形状が、グリット、ループまたは穴開き平板であることを特徴とする、請求項9に記載の帯電物品の中和装置。

【請求項11】上記対向電極は樹脂材料で被覆してあることを特徴とする、請求項9または10に記載の帯電物品の中和装置。

【請求項12】上記放電極は交流高压電源に接続され、上記対向電極は直流電源に接続され、上記対向電極へ印加する直流電圧の極性と大きさを調節できるようにしたことを特徴とする、請求項9、10または11のいずれかに記載の帯電物品の中和装置。

【請求項13】上記送気チャンバ内には清浄空気が導入され、上記スリット状開口から吹き出し速度が1m/s以上でかつ正または負にイオン化されたエアカーテンが形成され、このエアカーテン流れが板状の帯電物品に投射されるように構成したことを特徴とする、請求項1、2、3、4、5、6、7、8、9、10、11または12のいずれかに記載の帯電物品の中和装置。

【請求項14】帯電物品の中和装置は、その全体にわたり金属露出表面が存在していないことを特徴とする、請求項1、2、3、4、5、6、7、8、9、10、11、12または13に記載の帯電物品の中和装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、静電気を帯びた物品を高速度に除電する中和装置に係り、特に液晶基板製造におけるガラス大型基板の除電に威力を発揮するカーテン気流式除電装置に関する。

【0002】

【従来の技術】液晶パネル製造の分野においてガラス基板の帯電が大きな問題になっている。特に基板の大型化および素子の微細化が進む昨今では、ガラス大型基板の均一かつ高速の除電方法が求められている。

【0003】液晶パネルの製造では、液晶を配向させるためにガラス基板を布（パフ）で摩擦するラビング処理工程があるが、処理基板はサイズが大きく絶縁性であるため高い電位をまばら帯電する。たとえば、コーニング社製のガラス基板（Fusion 7059）を導体から10mmの所に浮かせ、表面をセルロースワイパー、ゴム手袋、

脱脂綿、アクリル製ローラー、毛製ローラーのそれぞれで3往復こすり帯電量を測定したところ、それぞれ+900～+1500V、-1000～-2000V、-1000～-200V、+200～+600V、-1000～-1500Vと言う結果が得られ、高いところでは電位の大きさに1KV～2KVにも及ぶ。

【0004】この様にガラス基板が帯電すると、静電気力によって浮遊粒子が付着したり静電気放電が生じたりして、基板上に形成される素子の断線、短絡や画像素子の視覚欠如等を招き、歩留まりを低下させてしまう。

【0005】帯電物品の除電を行う装置として従来よりコロナ放電を利用した各種のイオナイザが知られている。同一出願人に係る特開平3-230499号公報、特開平3-230500号公報、特開平4-106897号公報、特願平3-949842号、特願平3-174807号等において、発生する正負イオン濃度をバランスさせることができる各種の交流式イオナイザを提案した。

【0006】また空気調和、衛生工学会学術講演会講演論文集（平成3年10月31日～11月2日、石川）において、本発明者らは気流のない閉空間や気流の滞留域にある物品の除電に有効である空気吹き出しノズルとコロナ放電極を組み合わせたノズルタイプのイオナイザを発表した。

【0007】さらにイオナイザの放電時に電極が劣化し、金属微粒子が飛散して金属汚染が起こると言った問題を解決するために放電極を絶縁材で被覆したり、部材の金属露出面より生じる金属腐食の問題を解決するために対向電極をテフロンコートしたりすることを本発明者らは提案し、半導体製造プロセス等で有利な除電設備として昨今では実用に供されるに至っている。

【0008】先に提案したノズル式イオナイザは、ガス吹出開口を先端に有する筒状ノズルの中に絶縁材で被覆された金属製放電電極を設置し、この筒状ノズルの外側に樹脂で被覆された金属製対向電極を設置して帯電物品を中和するものである。このため、ノズル口より噴射する気流は先抜がりの放射線状となり、この気流によって搬送されるイオンも放射状に広がるために、広い面積を持つ大型除電物品をむらなく除電するには必ずしも適しておらず、大型化の進む液晶基板に対しては十分な除電効果が期待できない。

【0009】かかる問題点を解決するために、同一出願人に係る特願平4-248552号の「帯電物品の中和装置」において、図12および図13に示すように、送気源に接続され、かつカーテン気流形成用のスリット状開口部を有した送気チャンバ104と、高圧電源に接続されたコロナ放電用の複数本の放電極101からなり、該放電極が該スリット状開口部103にスリットの長手方向に沿って所定間隔で連設されていることを特徴とする帯電物品の中和装置を提供した。

【0010】この特願平4-248552号の装置では、送気チャンバ104のスリット状開口部103から空気イオンIを含むカーテン気流Aを吐出し、このカーテン気流の幅いっぱい若しくはこれより若干小さな一辺の長さをもつ広い表面積の帯電物品を均等に除電しようとした。この方式では、図11に示すように、吹き出し風量Qは、スリット状開口部103のスリット間隔Sとスリット開口幅Wと吹き出し風速Uの積で求められる（ $Q=S \times W \times U$ ）。このスリット状開口部103にスリットの長手方向に沿って所定間隔で連設された複数本の放電極101の先端近傍から発生した空気イオンIは、図11に示すように、カーテン気流A内を拡散混合しながら、気流によって運搬される。

【0011】しかしながら、除電対象の物品の寸法が大きい場合に十分な除電効果を得るためには、ある程度の大型の送風機などの送気源を用いざるを得ず問題であった。また、特願平4-248552号の装置では、放電極の対向電極102の形式はグリッドないしはリングであった（多角形や楕円であっても構わない）。かかるグリッドないしはリングの太さは、カーテン気流Aを乱さないために、出来るだけ細い方が望ましいが、その反面、その機械的強度の点から太さには限界があり、かかる相克点をどのように解決するかが問題であった。

【0012】

【発明が解決しようとする課題】したがって、本発明は上記のような問題点に鑑みなされたもので、その第1の目的は、帯電物品の除電効果を損なうことなく吹き出し風量を大幅に削減可能であり、その結果、送風機などの送気源の小型化と動力費を節約することが可能な新規かつ改良された帯電物品の中和装置を提供することである。

【0013】本発明の別の目的は、機械的強度に優れ、製造が容易であり、かつ製造コストが廉価でありながら、気流を乱して帯電物品の除電を損なうことのない新規かつ改良された対向電極を有する帯電物品の中和装置を提供することである。

【0014】本発明のさらに別の目的は、単一の装置で帯電物品に多数回、空気イオンを含んだカーテン気流を照射し、除電性能を高めることが可能な新規かつ改良された吐出部を備えた帯電物品の中和装置を提供することである。

【0015】本発明のさらにまた別の目的は、気流吹出口の数およびそれに応じた放電極の本数を加減するだけで除電の有効寸法を除電対象である帯電物品の寸法に合わせて任意に変更することが可能な新規かつ改良された帯電物品の中和装置を提供することである。

【0016】

【課題を解決するための手段】上記課題を解決するために、本発明の第1の観点によれば、送気源に接続され、かつカーテン気流形成用スリット状開口部を有した送気

チャンバと、高压電源に接続されたコロナ放電用の複数本の放電極からなり、その放電極が上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されて成る帯電物品の中和装置において、上記開口部をスペーサによりスリットの長手方向に沿って所定間隔で区画して複数の気流吹出口に分割し、その各気流吹出口に1または2以上の上記各放電極をそれぞれ配してなることを特徴とする、帯電物品の中和装置が提供される。

【0017】また、本発明の別の観点によれば、送気源に接続され、かつカーテン気流形成用スリット状開口部を有した送気チャンバと、高压電源に接続されたコロナ放電用の複数本の放電極からなり、その放電極が上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設されて成る帯電物品の中和装置において、上記送気チャンバを筒状に形成し、上記カーテン気流形成用の複数のスリット状開口部を上記筒状の送気チャンバのチャンバ軸の周りに放射状に設けたことを特徴とする帯電物品の中和装置が提供される。この場合にも、上記各開口部をスペーサによりスリットの長手方向に沿って所定間隔で区画して複数の気流吹出口に分割し、その各気流吹出口に1または2以上の上記各放電極をそれぞれ配設することが好ましい。

【0018】なお、上記気流吹出口の数が除電対象である帯電物品の寸法に応じて可変であることが好ましい。

【0019】また、上記各放電極は金属製の針状電極を絶縁材で被覆して構成することが可能である。あるいは、上記各放電極は、筒状の送気チャンバ内にチャンバ軸に沿って配線された1または2以上の被覆リード線に一端が接続されるように構成することも可能である。

【0020】さらに、各放電極の配置に関しては、上記各放電極を上記筒状の送気チャンバ内にチャンバ軸に沿って配線された被覆リード線の周りに放射線状に配列し、かつその一端を上記被覆リード線と接続し、さらに、上記放電極をチャンバ軸の周りに放射状に設けられた複数の上記スリット状開口部にスリットの長手方向に沿って所定間隔で連設するように構成することが可能である。あるいは、上記各放電極が上記筒状の送気チャンバ内にチャンバ軸に平行になるように配線された複数の被覆リード線に直交し、かつ放電極同士は互いに平行となるように配列し、かつ各放電極の一端を被覆リード線と接続し、上記放電極はチャンバ軸の周りに放射状に設けられた複数のスリット状開口部にスリットの長手方向に沿って所定間隔で連設するように構成することも可能である。

【0021】さらにまた、上記各放電極から所定の間隔を開けて配置されかつ接地または直流電源に接続された対向電極を設置し、その対向電極をスリット状開口部の内部または外部に取り付けることも可能である。この対向電極の形状としては、グリット、ループまたは穴開き平板とすることが可能であり、また、上記対向電極を樹

脂材料で被覆することも可能である。

【0022】また上記装置への電源接続に関しては、上記放電極を交流高压電源に接続し、上記対向電極を直流電源に接続し、上記対向電極へ印加する直流電圧の極性と大きさを調節できるように構成することが好ましい。

【0023】さらに、上記送気チャンバ内に清浄空気を導入し、上記スリット状開口部から吹き出し速度が1m/s以上でかつ正または負にイオン化されたエアカーテンを形成し、このエアカーテン流れが板状の帯電物品に投射されるように構成することが可能である。

【0024】さらにまた、帯電物品の中和装置は、その全体にわたり金属露出表面が存在しないように構成することが好ましい。

【0025】

【作用】請求項1によると、送気チャンバのスリット状開口部からカーテン気流を吐出する際に、そのカーテン気流に放電極から正または負のイオンを均等に放出させることができる。したがって、このイオン化されたカーテン気流はその幅いっぱい若しくはこれより若干小さな一辺の長さをもつ広い表面積の帯電物品を均等に除電できる。またその際に、帯電物品の除電効果を損なうことなく、例えば特願平4-248552号記載の従来装置に比較して、スペーサの占める分だけ開口面積が減少し、風量を大幅に削減できるので、送風機の小型化と動力費節約におおいに貢献する。さらに、このようなスペーサを有しない従来装置でみられた現象、つまりカーテン気流の脈動により、スリット状開口部が撓んでそのスリット幅が変動し、カーテン気流に乱れを生じるといった現象を防止できる。

【0026】請求項2によると、放射状に配置された開口部からカーテン気流が放射状に噴出されるので、広範囲にわたり帯電物品の除電を行うことができる。またこの場合にも、請求項3の装置のようにスペーサを配置することで、風量を大幅に削減するとともに、カーテン気流の乱れを防止することができる。

【0027】請求項4によると、放電極の本数を加減するだけで、除電対象である帯電物品の寸法に応じて、除電有効寸法を変更することができるので、ラインの除電効率を大幅に向上させることができる。

【0028】請求項5によると、金属製の針状電極を例えば石英ガラスなどの絶縁材で被覆すれば、コロナ放電を発生させた場合にも、電極が酸化やスパッタリングにより劣化して金属粒子などのパーティクルが発生するのを回避することができる。

【0029】請求項6によると、装置の組立が容易になるとともに、各放電極が着脱自在に取り付けられているので、帯電物品の寸法に合わせて気流吹出口の数およびそれに応じた放電極の本数を容易に加減することができる。

【0030】請求項7および請求項8によると、イオン

化されたカーテン気流が放射状に噴出するように吐出部がクラスタ状に構成されるので、広範囲にわたり帯電物品に対してカーテン気流を照射することができる。特に、帯電物品が送気チャンバの下方を水平方向に搬送され、その搬送方向にチャンバ軸が直交するように送気チャンバが配置される場合には、まず搬送方向に対して向かい風の空気イオンを含んだカーテン気流により帯電物品の除電を行い、さらに搬送方向に対して送り風の空気イオンを含んだカーテン気流により帯電物品の除電を再度行うことができるので、一回の除電で不十分な帯電物品に対して多数回の除電を実施することができる。

【0031】請求項9によれば、例えば導電性材料から構成された対向電極をスリット状開口部の内部または外部に取り付けることにより、コロナ放電を効率的に発生させることができる。また、対向電極を請求項10のような構成にすれば、機械的強度に優れ、製造が容易な対向電極構造を安いコストで製造することができる。また、請求項10の穴開き平板状の対向電極は、本発明に基づいてスペーサにより複数の吹出口に分割した場合には、各吹出口からのカーテン気流が通過できるように穴を開けておけば、気流に対して対向電極が障害とならない。さらに請求項11のように、対向電極を樹脂で被覆することにより対向電極の腐食による汚染の発生を防止することができる。

【0032】請求項12によれば、対向電極へ印加される電圧を調整することにより正負のイオン濃度をバランスさせて帯電の残留を防止することができる。

【0033】請求項13によると、コロナ放電によって発生する正負のイオンは、カーテン気流に乗って帯電物体に照射されると、帯電物体が正に帯電していれば負イオンが、負に帯電していれば正イオンが吸着して中和される。したがって、例えば液晶基板などの幅広の大型帯電物体をも効率的に除電し、その除電能力は吐出流の風速が速いほど高くなる。また、カーテン気流を形成する気体としては、コロナ放電生じるものであればその種類を問わないが、使用のし易さから空気が最も都合がよい。空気中に含まれる微粒子が除電対象物に付着して問題となる場合には、塵埃のない清浄空気を使用する。

【0034】請求項14の装置によれば、放電極や対向電極を含めカーテン気流を形成するための部材を全て金属表面が存在しないように構成することができる。これにより、イオナイザ自体が金属粒子の発塵源となることを防止できる。

【0035】

【実施例】以下に添付図面を参照しながら本発明に基づいて構成された帯電物品の中和装置の好適な実施例について説明する。

【0036】図1～図7は、本発明の帯電物品の中和装置の一実施例を示したものである。1は交流電圧が印加される放電極、20(2)、21は接地または直流電源

に接続される対向電極である。カーテン気流形成用のスリット状開口部3をもつ筒状の送気チャンバ4に対して、複数本の放電極1がスリットの長手方向に沿って所定間隔並ぶようにしてスリット状開口部3内に連接されている。

【0037】より具体的には、図2に見られるように軸と直交する断面が方形である筒状の送気チャンバ4の下面に軸方向に沿って幅の狭いスリット状開口3を設ける。他方、送気チャンバ4の一方端には図示しない送気源に接続される供給口5を設け、また多孔板6によって、供給口5からスリット状開口3に至る送気チャンバ内空間を上下に二分する。図示の例では供給口5を送気チャンバ4の一方端に設けているが、供給口5を送気チャンバ4の上部に設けた構成とすることも可能である。

【0038】この多孔板6によって仕切られるチャンバ内の上部空間7は、多孔板6が気流の抵抗となるので給気プレナムとして作用し、供給口5から導入された気流Sは多孔板6で整流されて下部空間8に流れ、スリット状開口部3から幅方向にほぼ等速のカーテン気流が吐出する。

【0039】さらに本発明によれば、図1および図2に示されるように、スリット状開口部内にスペーサ9を取り付けて、スペーサ9によって区画された多数の吹出口10を形成し、単数または複数の放電極1を個々の吹出口10にスリットの長手方向に沿って所定間隔で連設している。

【0040】このように構成することにより、図6および図11を比較すれば容易に理解できるように、スリット間隔Sと吹き出し風速Uが2つの装置で同じであると仮定すると、図6に示す本発明装置によれば、図11に示す従来装置に比較して、吹き出し風量Qがスペーサ9の占める面積分だけ削減することが可能である。この場合、図6に示すように、スペーサ9によって区画された個々の吹出口10から吐出する空気イオンIを含む多数のカーテン気流Aは、徐々に拡散して混合し、遂には図11に示したカーテン気流とほとんど変わらない単一のカーテン気流に発達する。除電効果は帯電物品に到達する単位時間当たりのイオン総量に依存するから、本発明によれば、本発明によれば、帯電物品の除電効果が損なうことなく、吹き出し風量Qを大幅に削減できるので、送風機の小型化と動力費節約を図ることができる。

【0041】また本発明装置においては、図1および図2に示すように、下部空間8内に軸方向に沿ってリード線11が張り渡される。このリード線は、テフロン製のチューブ12内に金属導体13が挿入されたものであり、この金属導体13に導通関係をもって各放電極1の一端が、例えばネジ14を備えたホルダ18により着脱自在に連結されている。そのさい各放電極1はリード線11から吹出口10内のほぼ中心を通るように配置され、図示の例ではその先端15が開口3から若干外側に

突出している。

【0042】さらに、この放電極1は、針状の金属電極（タングステン電極）16を絶縁材17で完全に被覆してある。絶縁材17には石英ガラスからなる管状体を使用されている。より具体的には、ネジ14を備えたホルダ18に一端が固定された石英ガラス管17内に同心円的に針状電極16が取付けられ、石英ガラス管17の封止された先端も先尖りに形成され、この先端部内側に針状電極16の先端が当接している。

【0043】ホルダ18はリード線11のテフロンチューブ12に対してネジ14を介して脱着可能に取付けられ、このテフロンチューブ12を貫通して放電極内部の金属電極16がリード線内部の金属導体13に連結している。

【0044】このようにして多数本の放電極1が所定の間隔をあけてスリットの長さ方向に沿って設置されるが、各放電極1から間隙をあけて接地または直流電源に接続される対向電極20、21が取付けられている。直流電源に接続した場合には、その印加する直流電圧の極性と大きさを調節することによって正負のイオン濃度を

【0045】従来装置では、図12および図13に示すように、対向電極2の形式はグリッドないしはリングであった（多角形や楕円であっても構わない）。このグリッドまたはリングの太さは、カーテン気流を乱さないように、出来るだけ細い方が望ましいが、他方で、その機械的強度の点から問題があった。。

【0046】この点本発明では、図4および図5に示すように、機械的強度、製造の容易さ、コスト等を考慮して、板状導電材料、例えばステンレス鋼板20から成る対向電極2に、個々の吹出口10に対応する位置に穴21（形状は、円、多角形、楕円など任意）を開け、個々の吹出口10からのカーテン気流に対して、対向電極2が障害物にならないように工夫した。なお、従来の特願平4-248552号装置により形成される単一のカーテン気流に、本発明の図4または図5の対向電極形状を適用すると、孔と孔の境目部分がカーテン気流に対して、障害となり、気流を著しく乱し、帯電物品の除電効果が損なわれてしまう。したがって、従来装置に図4および図5に示す対向電極形状を適応させることはできない。

【0047】次に図7および図8を参照しながら、筒状の送気チャンバ4に、カーテン気流形成用の複数のスリット状開口部33、43および53、63が、チャンバ軸の周りに放射状に設けられ、筒状の送気チャンバからカーテン気流が放射状に噴出するようなクラスタ形状の吐出部の構造について説明する。

【0048】図7では、各放電極31または41は、筒状の送気チャンバ4内にチャンバ軸に沿って配線された被覆リード線11の周りに、互いに直交し、鉛直下方と

45°をなす方向に等間隔に配列され、かつその一端はホルダ35および45を介して被覆リード線11と接続される。同様にチャンバ軸の周りに、互いに直交し、鉛直下方と45°をなす方向に設けられたスリット状開口部33および43に、該放電極を、スリットの長手方向に沿って所定間隔で連設される。さらに上部空間7と下部空間8は多孔板6により仕切られている。また、上部空間7は隔離板38により2つの空間に分割され、2つの流路を形成するように構成されている。

【0049】図8では、二本の被覆リード線59および69が筒状の送気チャンバ4内にチャンバ軸に平行になるように配線されており、各放電極51または61は、それぞれ対応する被覆リード線59または69に直交し、かつ放電極同士51および61は互いに平行となるように配列されている。また各放電極の一端はホルダ18により被覆リード線59および69にそれぞれ着脱自在に接続されている。送気チャンバ4にカーテン気流形成用のスリット状開口部が2ヶ所（53および63）設けられ、カーテン気流は互いに直交し、鉛直下方と45°方向に吐出する。二本の被覆リード線59および69のそれぞれに接続された該放電極51および61は、チャンバ軸の周りに放射状に2ヶ所設けられたスリット状開口部53および63にスリットの長手方向に沿って所定間隔で連設されている。さらに図7の実施例と同様に、上部空間7と下部空間8は多孔板6により仕切られている。また、上部空間7は隔離板38により2つの空間に分割され、2つの流路を形成するように構成されている。

【0050】図7および図8に示すクラスタ状の空気流吐出口の構造は、スリット状開口部33、43および53、63が、それぞれチャンバ軸の周りに放射状に設けられ、それぞれの開口部に放電極31、41および51、61が配置されている以外は、基本的には図2に関連して説明した構成と同じであり、同じ機能を発揮する部材については同じ符号を付することによりその説明を省略する。

【0051】上記のように構成された図7および図8に示すようなクラスタ形状のカーテン気流吐出部を備えた装置においては、この送気チャンバ下方をガラス基板が水平方向に運搬される場合に、ガラス基板は最初に水平方向と45°をなす方向からの空気イオンを含んだ向かい風に曝されて除電される。その後、同ガラス基板は水平方向と45°をなす方向からの空気イオンを含んだ追い風に曝されてもう一度除電される。その結果、除電が一度で不十分な場合であっても、図7および図8に示すようなクラスタ形状の吐出部を設けて、帯電物品に多数回にわたり、空気イオンを含んだカーテン気流を照射することにより、十分な除電を行うことが可能となる。

【0052】次に本発明に基づいて構成された帯電物品の中和装置による除電性能を、特願平4-248552

10

20

30

40

50

号に記載の従来装置の比較において説明する。比較試験は図9にその概要を示す装置70によって行った。また、図10は、本発明による装置を機能させるための主要構成機器である。

【0053】ガラス基板71は、絶縁体であるシリコン樹脂で作られたステージ72上に置かれる。運搬装置73により、このステージ72は、荷電装置79を中心として、荷電装置79の直下をくぐり抜けるように、左右方向に動く。ガラス基板71の表面を強制的に帯電するには、荷電装置の放電バーから正または負の空気イオンを発生させ、ステージ上のガラス基板71を任意の速度で運搬することにより、基板面全体を均等に帯電させる。ガラス基板の表面電位は、放電バーへの印加電圧、運搬速度、及び運搬繰り返し回数、の組合せにより変化する。

【0054】以下に、性能試験の主な手順を示す。

(1) ガラス基板71を、左側から右側へ運搬しながら、荷電装置79によって強制的に帯電させる。

(2) 荷電装置79の電源を切り、ガラス基板71上の表面電位を表面電位計74にて測定する。

(3) FFU (ファンフィルタユニット) 75と本発明に基づいて構成された中和装置 (イオナイザ) 76の電源をいれ、イオンコントローラ77を用いて正と負のイオンの発生量をバランスさせる。正と負のイオンの発生量がバランスしたかどうかは極性偏位モニタ78によって察知する。

(4) ガラス基板71を右側から左側へ運搬しながら中和装置 (イオナイザ) 76にて除電する。

(5) ガラス基板71が中和装置76の下を通過した後すぐ中和装置 (イオナイザ) 76の電源を切り、再びガラス基板71を右側から左側へ運搬し、除電後のガラス基板71の表面電位を表面電位計74にて測定する。

【0055】また、性能試験の測定条件は次の通りである。

室温：23℃

相対湿度：17%～52% (可変)

吹出平均風速：12m/s

荷電装置の印加電圧：±15KV、直流 (D、C)

基板運搬速度：0.1m/s (ガラス基板へイオン風を3秒照射)

ガラス基板：コーニング社製大型無アルカリガラス (Fusion #7059) (300×400×1.1mm³)

【0056】(比較例) まず、比較例として図11～図15に示す特願平4-248552号の従来帯電物品の中和装置を用いた性能実験について説明する。101は交流電圧が印加される放電極、102はアースまたは直流電源に接続される対向電極である。カーテン気流形成用のスリット状開口部103をもつ筒状の送気チャンバ104に対して、複数本の放電極101がスリットの長手方向に沿って所定間隔で並ぶようにしてスリット状

開口部103内に連設されている。

【0057】より具体的には、図13に見られるように軸と直交する断面が方形をもつ筒状の送気チャンバ104の下面に軸方向に沿って幅の狭いスリット状開口103を設ける。他方、送気チャンバ104の上面には送気源に接続される供給口105を設け、また多孔板106によって、供給口105からスリット状開口103に至る送気チャンバ内空間を上下に二分する。

【0058】この多孔板106によって仕切られるチャンバ内の上部空間107は、多孔板106が気流の抵抗となるので給気プレナムとして作用し、供給口105から導入された気流は多孔板106で整流されて下部空間108に流れ、スリット状開口部103から幅方向にほぼ等速のカーテン気流が吐出する。

【0059】この下部空間108内に軸方向に沿ってリード線109が張り渡される。このリード線は、テフロン製のチューブ110内に金属導体111が挿入されたものであり、この金属導体111に導通関係をもって各放電極101の一端が連結されている。このさい各放電極101はリード線109からスリット状開口103のほぼ中心を通るように配置され、図示の例ではその先端112が開口103から若干外部に突出している。

【0060】このようにして多数本の放電極101が所定の間隔を開けてスリットの長さ方向に沿って設置されるが、各放電極101から間隔をあけて接地または直流電源に接続される対向電極102が取り付けられている。直流電源に接続した場合には、その印加する直流電圧の極性および大きさを調整することによって正負のイオン濃度をバランスさせて帯電の残留を防止できる。

【0061】図11～図15の例では、対向電極102が図14に見られるようにグリッド状を有しており、各グリッドのほぼ中央位置に放電極101が位置している。

【0062】気体の供給口105、筒状の送気チャンバ104並びにスリット状開口103などのカーテン気流形成の部材はすべて樹脂 (例えばアクリル樹脂) で構成されている。また対向電極102も樹脂で被覆することもできる。これによって対向電極102の腐食が防止され、腐食した対向電極102が金属粒子の発生源となることが回避できる。

【0063】本実施例に用いた装置のスリット幅は4mmであり、放電極101の先端部はスリット状開口部3から6mm突出している。また放電極101は石英ガラスで被覆し、30mmピッチで15本取り付け、30mm×30mmのグリッド状導電体を放電極101の先端部から10mm離れた位置に対向電極として設けた。

【0064】放電極へは11.5kVの交流電圧を印加し、正と負の発生イオン濃度を均衡するために、対向電極へは-30～-500Vの直流電圧をかけた。送気チャンバへの気体にはHEPAフィルタを通した清浄空気を用

い、カーテン気流の吹き出し風速を 12 m/s とし、図15に示すようにガラス基板となす角度が 60° の方向からガラス基板面にカーテン気流を照射した。

【0065】コーニング社製の大型無アルカリガラス(Fusion #7059) ($300 \times 400 \times 1.1\text{ mm}^3$)を除電対象の帯電物体として、本実施例に用いた装置の除電性能を調べた。図16および図17はガラスが正に帯電した場合、図18および図19はガラスが負に帯電した場合の測定結果である。空気イオンを含むカーテン気流をわずか3秒間照射するだけで、搬送中の大型ガラス基板($300 \times 400\text{ mm}^2$)の帯電(最大 5 kV)を、全面にわたってムラなく一様に、90%以上除電できた。

【0066】なお、除電率は、つぎのように定義した。 a を除電前の表面電位、 b を除電後の表面電位とすると、除電率 $=|a-b|/|a|$ となる。

【0067】吹き出し風量 Q は、スリット隙間 $S=4\text{ m}$ とスリット開口幅 $=450\text{ mm}$ と吹き出し風速 $U=12\text{ m/s}$ の積で求められる。 $Q=1.3\text{ m}^3/\text{min}$ となった。

【0068】なお、カーテン気流が水平方向と成す角度が 30° 以上であれば、図20に示すように除電率は90%を超えることが測定によって明らかになった。図中の列数は図21のガラス基板の正または負の表面電位の測定列のうちで最も除電率の低い列を示している。

【0069】(本実施例1)性能試験に用いた本発明の装置は図3および図4に示す通りである。図11~図15に示す従来装置と異なる点は、

【0070】a) 15本の放電極1の各々は、スペーサ9によって区画された $4\text{ mm} \times 15\text{ mm}$ のスリット状開口部に配置される。従って本実施例の装置全体の吹き出し開口面積 $A=4\text{ mm} \times 15\text{ mm} \times 15\text{ ケ}=9\text{ cm}^2$ となり、図11~図15に示す従来装置の開口面積 18 cm^2 の半分になっている。

【0071】b) 対向電極2の形状が穴開き平版20であること。具体的には、幅 40 mm のステンレス板に、 30 mm 間隔で直径 28 mm の穴を15ヶ開け、15本の放電極1の各々が対応するようにしたこと。なお、図3および図4に示す実施例では、対向電極2の幅 40 mm の両側にツバ22を付けて補強している。

【0072】既発明の実施例と全く同じ条件で、コーニング社製の大型無アルカリガラス(Fusion #7059) ($300 \times 400 \times 1.1\text{ mm}^3$)を除電対象の帯電物品として、本実施例の装置の除電性能を調べた。既発明の実施例の除電性能を表す図16~図19と同様に、空気イオンを含むカーテン気流をわずか3秒間照射するだけで、搬送中の大型ガラス基板($300 \times 400\text{ mm}^2$)の帯電の大きさ(最大 5 kV)を、全面にわたってムラなく一様に、90%以上除電できた。

【0073】ここで、吹き出し風量 Q は、装置全体の吹

き出し開口面積 $A=9\text{ cm}^2$ と吹き出し風速 $U=12\text{ m/s}$ の積で求められる。 $Q=0.65\text{ m}^3/\text{min}$ となった。つまり、除電性能は前述の既発明実施例とほとんど変わらないにもかかわらず、本発明実施例の吹き出し風量は既発明実施例の半分に削減でき、本発明によれば、送風機の小型化と動力費節約を図ることができる。

【0074】(本実施例2)次に図7および図8に示すクラスタ形状の吐出部を備えた帯電物品の中和装置に対する性能実験について説明する。両図の実施例の装置とも、実施例1の装置と同様に、15本の放電極から成る2つの放電極列31、41および51、61を有する。各放電極列は本発明の実施例1と同様に、個々の放電極がスペーサによって区画された $4\text{ mm} \times 15\text{ mm}$ のスリット状開口部に配置され、対向電極は幅 40 mm のステンレス板に、 30 mm 間隔で直径 28 mm の穴を15ヶ開け、15本の放電極の各々が対応するようにした構造である。

【0075】本発明の実施例1と全く同じ条件で、コーニング社製の大型無アルカリガラス(Fusion #7059) ($300 \times 400 \times 1.1\text{ mm}^3$)を除電対象物品として、本発明実施例2の装置の除電性能を調べた。その結果、ガラス基板の除電率は99%以上となった。

【0076】本実施例では、送気チャンパ下方をガラス基板が水平方向に搬送される場合、ガラス基板は最初に水平方向と 45° となす方向からの空気イオンを含んだ向かい風に曝されて除電される。その後、同ガラス基板は水平方向と 45° をなす方向からの空気イオンを含んだ追い風に曝されてもう一度除電される。図3および図4に示す本発明実施例1では、空気イオンを含むカーテン気流をわずか3秒間だけ運搬速度 10 cm/s の大型のガラス基板($300 \times 400\text{ mm}^2$)に照射するだけで、その帯電の大きさ(最大 5 kV)を、全面にわたってムラなく一様に、90%以上除電できた。本実施例のように、空気イオンを含むカーテン気流をガラス基板に2度照射した場合、1回当たり90%以上の除電を2度繰り返すのであるから、理論的にも99%以上の除電効率が得られる。

【0077】なお、実施例1、2ともに、大型のガラス基板($300 \times 400\text{ mm}^2$)を対象として、帯電除去を行ったため、基板の長辺寸法 400 mm に合わせて、本発明装置の放電極を 30 mm 間隔で15本配列した。つまり、本発明装置の除電に有効な寸法は 420 mm となる。ただし、本発明によれば、放電極の間隔 30 mm と吹き出し風速はそのままの状態、放電極の本数のみを変えれば、本発明装置の除電に有効な寸法を基板寸法に合わせて任意に変えることができる。この場合、放電極の本数が変わっても本発明装置によるガラス基板の除電効率は全く影響されないことが確かめられた。

【0078】

【発明の効果】以上説明したように、本発明によれば、

帯電物品の除電効果を損なうことなく吹き出し風量を大幅に削減可能であり、その結果、送風機などの送気源の小型化と動力費を節約することが可能である。また、本発明装置の穴開き平板の対向電極構造は、従来装置に比較して、機械的強度に優れ、製造が容易であり、かつ製造コストが廉価でありながら、気流を乱して帯電物品の除電を損なうこともない。

【0079】また本発明に基づいて構成されたクラスタ形状の吐出部を備えた装置によれば、単一の装置で帯電物品に多数回、空気イオンを含んだカーテン気流を照射し、除電性能を高めることが可能である。

【0080】さらに、本発明によれば、放電極の本数を加減するだけで除電の有効寸法を除電対象である帯電物品の寸法に合わせて任意に変更することが可能である。その場合に、吹き出し風速および放電極間隔を変更する必要はない。

【図面の簡単な説明】

【図1】本発明装置の一実施例を示す略断面図である。

【図2】図1の装置のI-I線矢視断面図である。

【図3】本発明装置の一実施例を示す略正面図である。

【図4】図3の装置の底面図である。

【図5】本発明装置の一実施例の略見取図である。

【図6】本発明装置に基づいて形成されたカーテン気流の説明図である。

【図7】本発明に基づいて構成された装置のクラスタ形状吐出部の一実施例を示す略断面図である。

【図8】本発明に基づいて構成された装置のクラスタ形状吐出部のさらに別の実施例を示す略断面図である。

【図9】帯電物品の中和装置の性能試験を実施するための装置の主要構成機器を示す説明図である。

【図10】本発明装置を機能させるための主要構成機器を示す説明図である。

【図11】従来装置に基づいて形成されたカーテン気流の説明図である。

* 【図12】従来装置の略断面図である。

【図13】図12の装置のI-I線矢視断面図である。

【図14】図12の装置の底面図である。

【図15】イオン風を基板面と60°の角度で照射した場合のカーテン気流の吹き出し方向を示す説明図である。

【図16】イオン風を基板面と60°の角度で照射した場合の除電前の正極性帯電電位を示すグラフである。

【図17】イオン風を基板面と60°の角度で照射した場合の除電後の正極性帯電電位を示すグラフである。

【図18】イオン風を基板面と60°の角度で照射した場合の除電前の正極性帯電電位を示すグラフである。

【図19】イオン風を基板面と60°の角度で照射した場合の除電後の正極性帯電電位を示すグラフである。

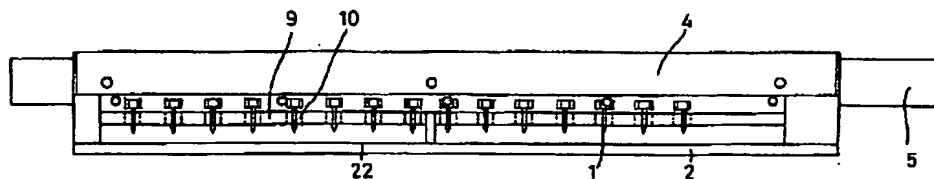
【図20】カーテン気流の吹き出し方向と除電率との関係を示すグラフである。

【図21】ガラス基板の表面電位の測定列を示す説明図である。

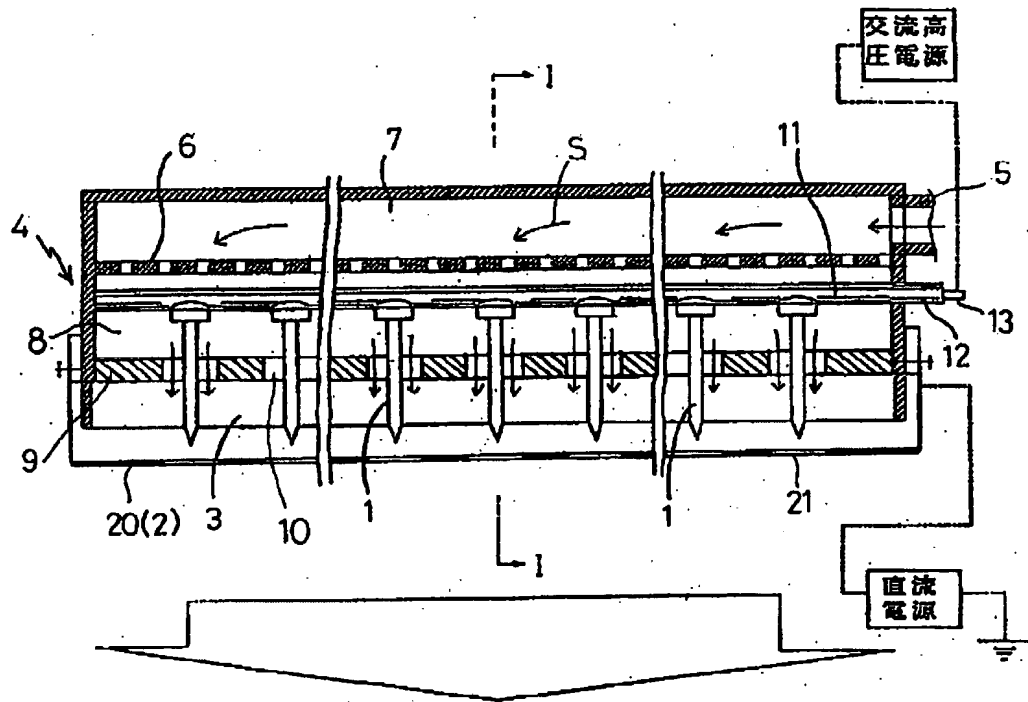
【符号の説明】

- | | |
|----|----------|
| 1 | 放電極 |
| 2 | 対向電極 |
| 3 | スリット状開口 |
| 4 | 送気チャンバ |
| 5 | 送気源への接続口 |
| 6 | 多孔板 |
| 7 | 上部空間 |
| 8 | 下部空間 |
| 9 | スパーサ |
| 10 | 吹出口 |
| 11 | 放電極のリード線 |
| 15 | 放電極の放電端 |
| 17 | 石英ガラス管 |
| 18 | ホルダ |

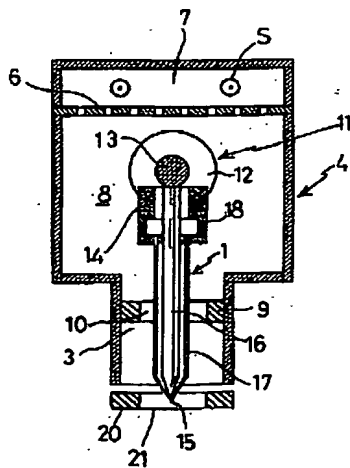
【図3】



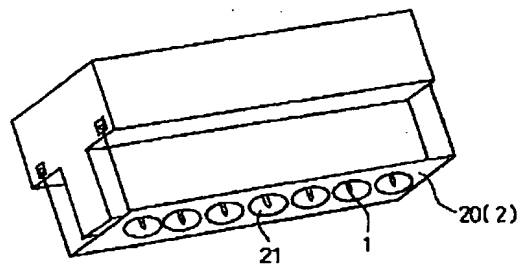
【図1】



【図2】

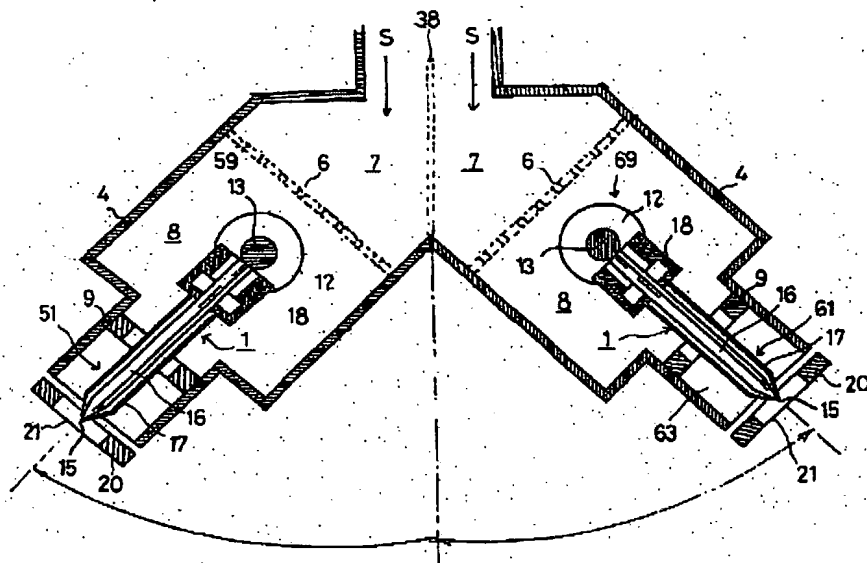


【図5】

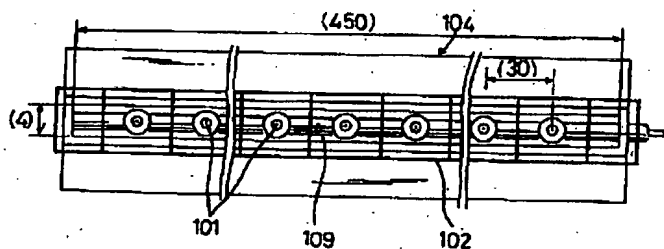


[illegible]

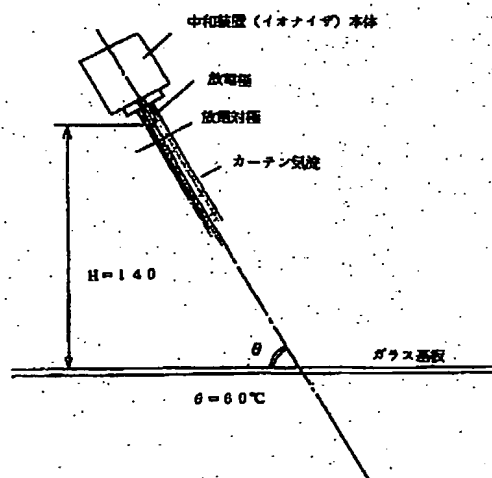
【図8】



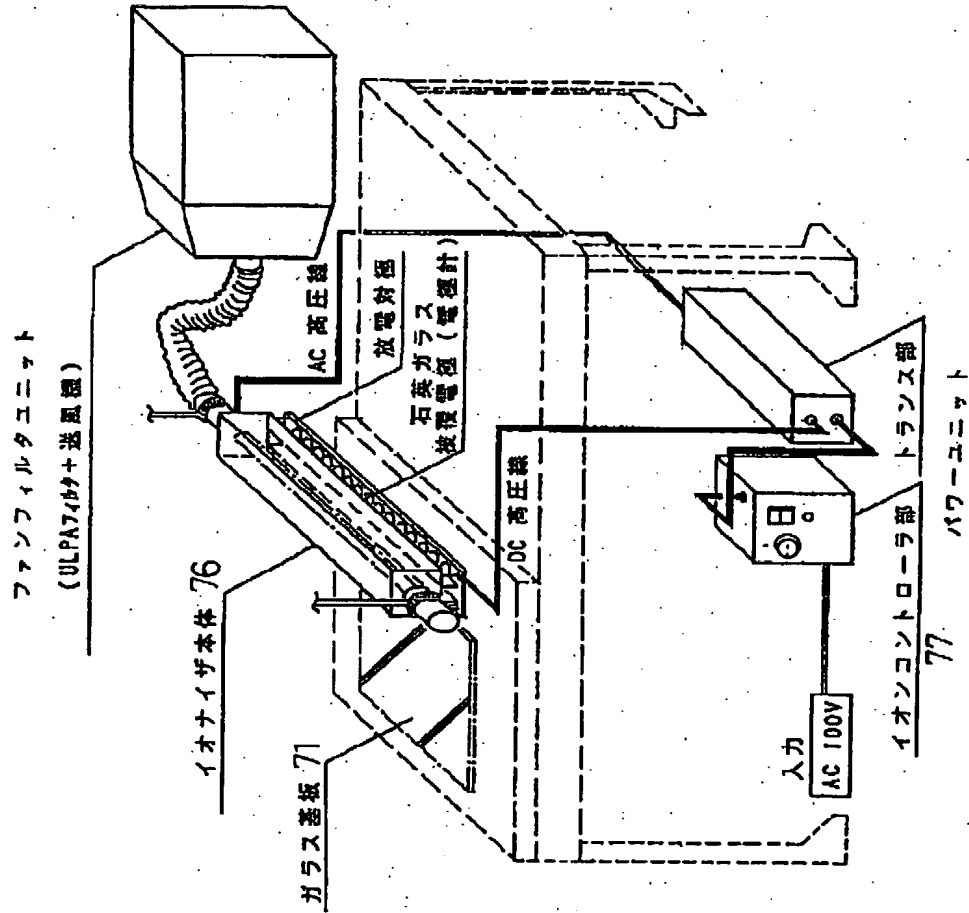
【図14】



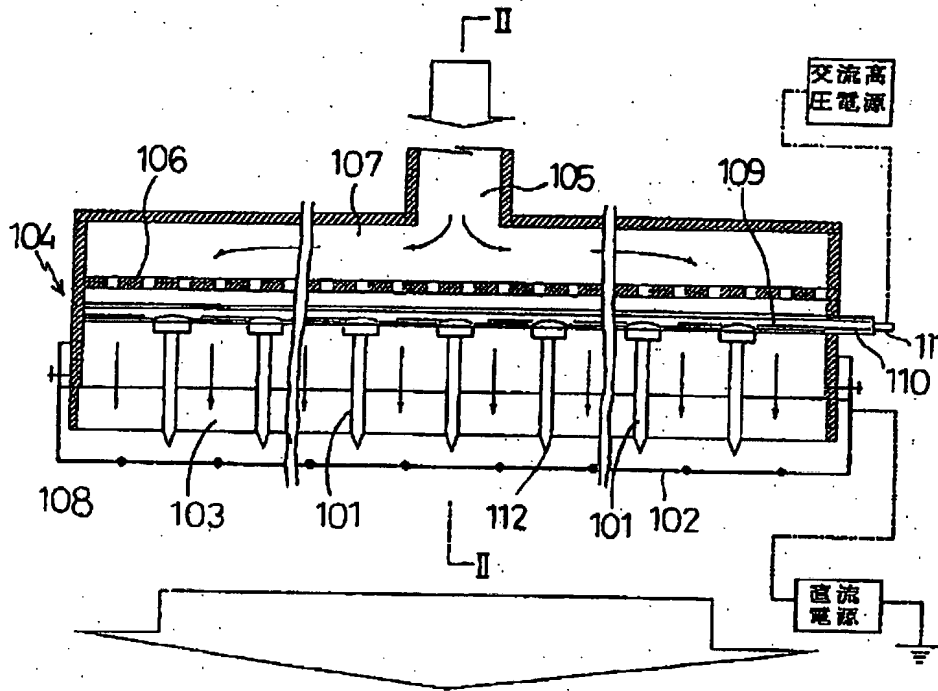
【図15】



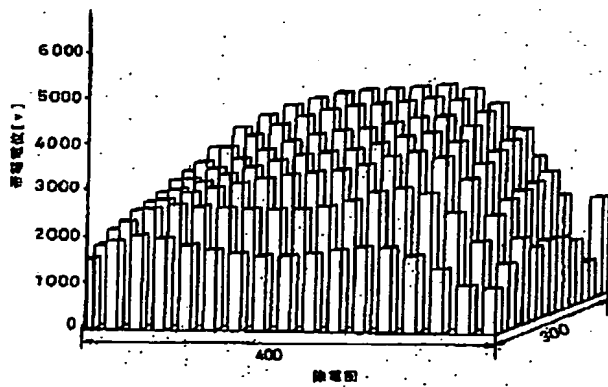
【図10】



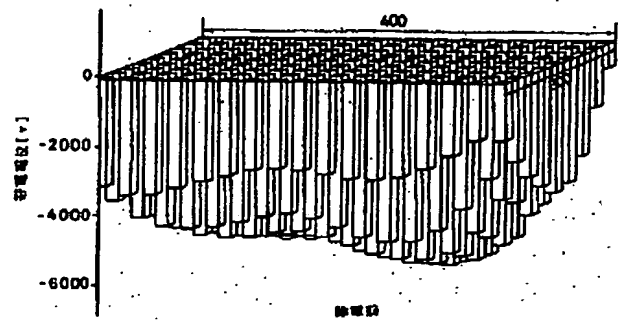
【図12】



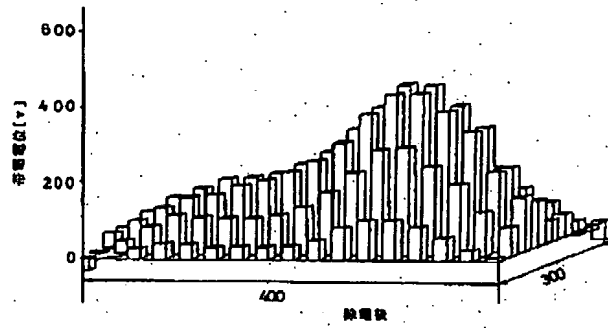
【図16】



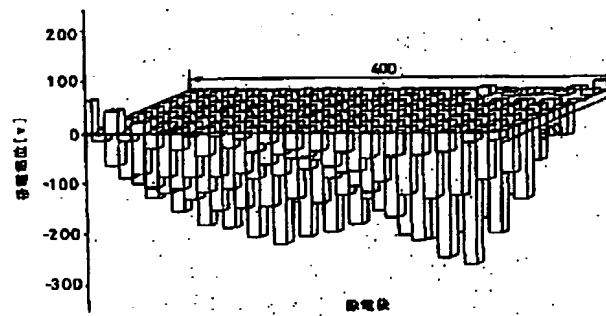
【図18】



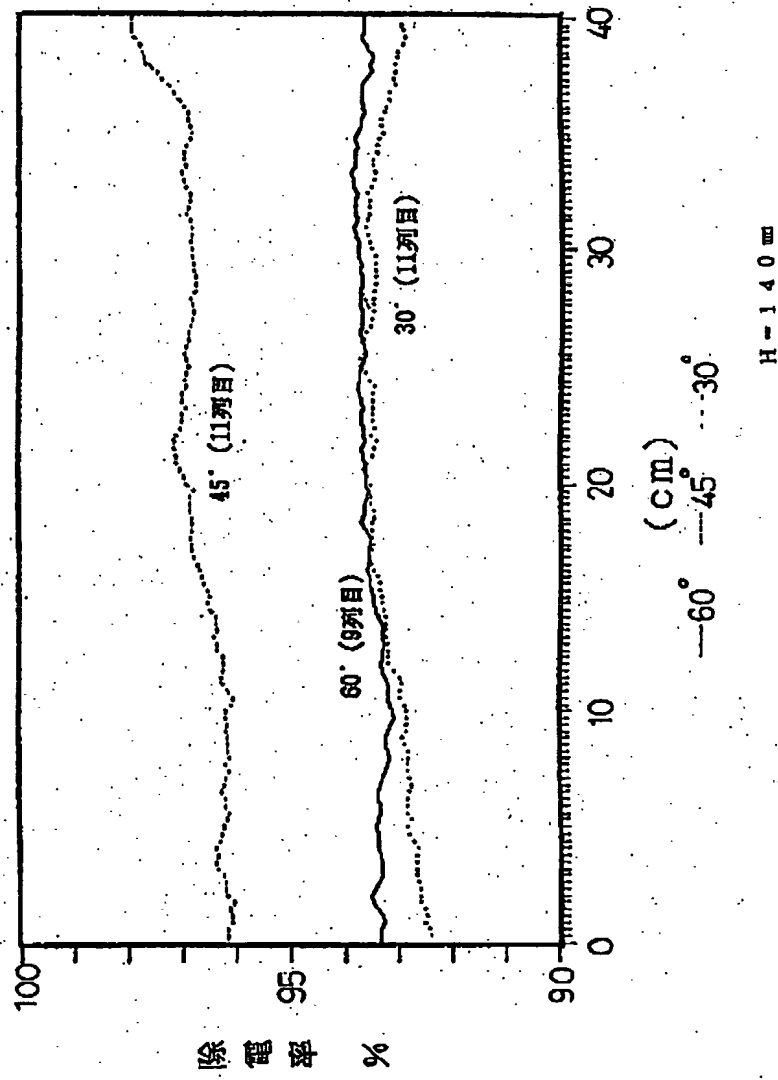
【図17】



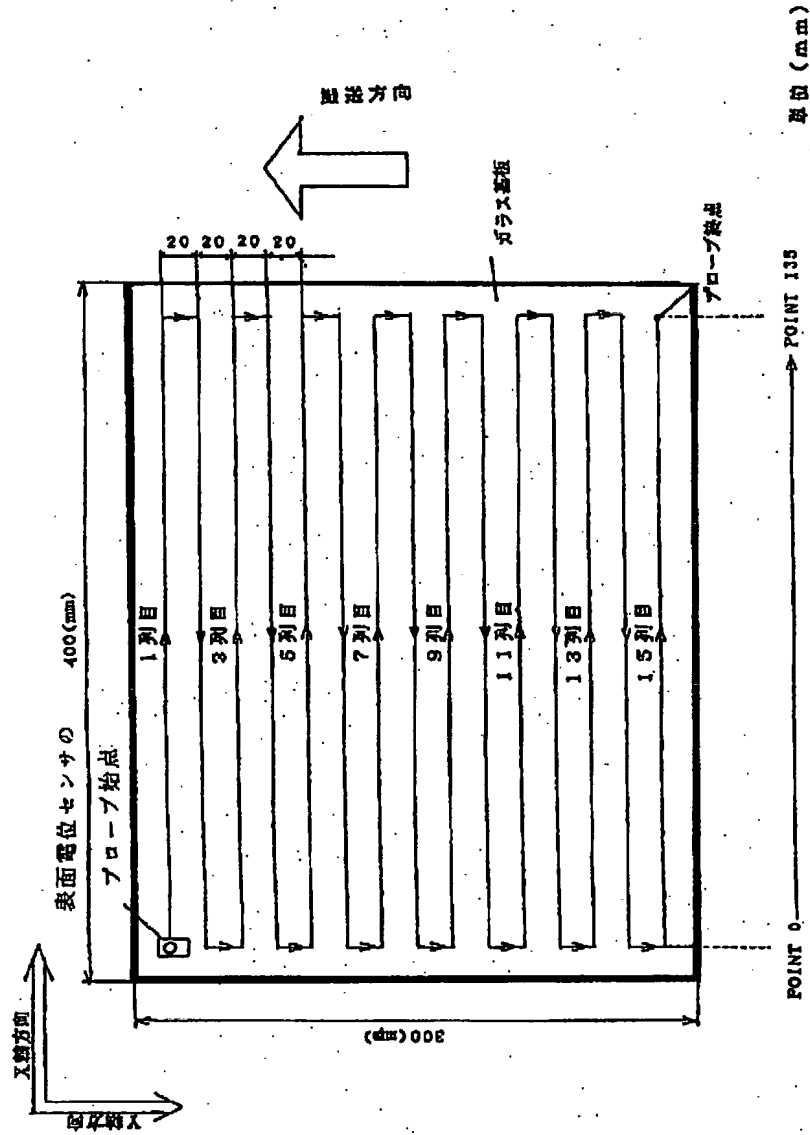
【図19】



【図20】



【図21】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-275366

(43)Date of publication of application : 30.09.1994

(51)Int.Cl.

H01T 19/04

(21)Application number : 05-088172

(71)Applicant : TAKASAGO THERMAL ENG CO
LTD

(22)Date of filing : 22.03.1993

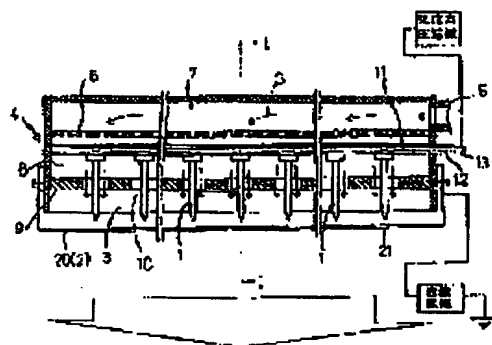
(72)Inventor : SATO KATSUMI
SAKATA SOICHIRO

(54) NEUTRALIZATION DEVICE FOR ARTICLE CHARGED WITH ELECTRICITY

(57)Abstract:

PURPOSE: To provide a neutralization device for an article charged with electricity, which can largely reduce an amount of blast without impairing static electricity eliminating efficiency.

CONSTITUTION: This neutralization device for an article charged with electricity comprises an air supplying chamber 4 connected to an air supplying source and having a slit-like opening part 3 used for forming a curtain air current and a plurality of discharging electrode 1 used for corona discharge use which is connected to a high-voltage power supply, in which the discharging electrode is provided at a predetermined interval along in the direction of the length of a slit in the slit-like opening part 3. The opening part is partitioned at a predetermined interval along the length direction of a slit with a spacer 9 to be divided in a plurality of air current blowing openings 10 to assign each discharging electrode respectively for each air current blowing opening. With this device, an opening area is reduced by a part occupied by the spacer, so that an amount of blast may be reduced.



LEGAL STATUS

[Date of request for examination] 26.02.1998

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3401702

[Date of registration] 28.02.2003

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] A supplied-air chamber with [connect with the source of a supplied air, and] slit-like opening for curtain air-current formation, In the neutralization equipment of the electrification article which it consists of two or more discharge electrodes for corona discharge connected to the high voltage power supply, and the discharge electrodes are formed successively by the above-mentioned slit-like opening at intervals of predetermined along with the longitudinal direction of a slit, and changes Neutralization equipment of the electrification article which divides the above-mentioned opening at intervals of predetermined along with the longitudinal direction of a slit with a spacer, divides into two or more air-current outlets, and is characterized by coming to allot each 1 or 2 or more above-mentioned discharge electrodes to each of that air-current outlet, respectively.

[Claim 2] A supplied-air chamber with [connect with the source of a supplied air, and] slit-like opening for curtain air-current formation, In the neutralization equipment of the electrification article which it consists of two or more discharge electrodes for corona discharge connected to the high voltage power supply, and the discharge electrodes are formed successively by the above-mentioned slit-like opening at intervals of predetermined along with the longitudinal direction of a slit, and changes Neutralization equipment of the electrification article characterized by having formed the above-mentioned supplied-air chamber in tubed, and preparing two or more slit-like openings for [above-mentioned] curtain air-current formation in the surroundings of the chamber shaft of the above-mentioned tubed supplied-air chamber at a radial.

[Claim 3] Neutralization equipment of the electrification article according to claim 2 which divides each above-mentioned opening at intervals of predetermined along with the longitudinal direction of a slit with a spacer, divides into two or more air-current outlets, and is characterized by coming to allot each 1 or 2 or more above-mentioned discharge electrodes to each of that air-current outlet, respectively.

[Claim 4] Neutralization equipment of the electrification article according to claim 1 or 3 characterized by the number of the discharge electrode attached in the above-mentioned air-current outlet being adjustable.

[Claim 5] Each above-mentioned discharge electrode is neutralization equipment of an electrification article given in either of claims 1, 2, 3, or 4 which is characterized by having covered the metal needlelike electrode with the insulating material.

[Claim 6] Each above-mentioned discharge electrode is neutralization equipment of an electrification article given in either of claims 1, 2, 3, 4, or 5 which is characterized by connecting the end to 1 or two or more coat lead wire which were wired in accordance with the chamber shaft in the tubed supplied-air chamber free [attachment and detachment].

[Claim 7] Each above-mentioned discharge electrode is arranged in the shape of a radiation around the coat lead wire wired in accordance with the chamber shaft in the above-mentioned tubed supplied-air chamber. And the end is connected with the above-mentioned coat lead wire free [attachment and detachment], and it is further characterized by the above-mentioned discharge electrodes being formed successively at intervals of predetermined along with the

longitudinal direction of a slit by two or more above-mentioned slit-like openings prepared in the surroundings of a chamber shaft at the radial. Neutralization equipment of an electrification article given in either of claims 2, 3, 4, 5, or 6.

[Claim 8] Two or more coat lead wire wired so that it might come in parallel with a chamber shaft in the above-mentioned tubed supplied-air chamber, and each above-mentioned discharge electrode cross at right angles. And it is arranged and the end of each discharge electrode is connected with coat lead wire free [attachment and detachment] so that discharge electrodes may become parallel mutually. The above-mentioned discharge electrode is neutralization equipment of an electrification article given in either of claims 2, 3, 5, or 6 which is characterized by being formed successively at intervals of predetermined along with the longitudinal direction of a slit by two or more slit-like openings prepared in the surroundings of a chamber shaft at the radial.

[Claim 9] Furthermore, neutralization equipment of an electrification article given in either of claims 1, 2, 3, 4, 5, 6, or 7 which the counterelectrode which opened predetermined spacing, and has been arranged from each above-mentioned discharge electrode, and was connected to touch-down or DC power supply is installed, and is characterized by attaching the counterelectrode in the interior or the exterior of slit-like opening.

[Claim 10] Neutralization equipment of the electrification article according to claim 9 with which the configuration of the above-mentioned counterelectrode which opened predetermined spacing and was installed from each discharge electrode is characterized by being a shot, a loop formation, or a hole aperture plate.

[Claim 11] The above-mentioned counterelectrode is neutralization equipment of the electrification article according to claim 9 or 10 characterized by having covered with the resin ingredient.

[Claim 12] It is neutralization equipment of an electrification article given in either of claims 9, 10, or 11 which the above-mentioned discharge electrode is connected to an alternating current high voltage power supply, and the above-mentioned counterelectrode is connected to DC power supply, and is characterized by enabling it to adjust the polarity of the direct current voltage impressed to the above-mentioned counterelectrode, and magnitude.

[Claim 13] Neutralization equipment of an electrification article given in either of claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12 which clarification air is introduced in the above-mentioned supplied-air chamber, and the air curtain which the above-mentioned slit-like opening to a blowdown rate is 1 or more m/s, and was ionized by forward or negative is formed, and is characterized by constituting so that it may be projected on this air curtain flow by the tabular electrification article.

[Claim 14] The neutralization equipment of an electrification article is neutralization equipment of an electrification article given in claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13 characterized by the rear-spring-supporter metal exposure front face not existing in the whole.

[Translation done.]

*** NOTICES ***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the curtain air-current type electric discharger which is built over the neutralization equipment which discharges the electrified article at high speed, especially demonstrates power to electric discharge of the glass large-sized substrate in liquid crystal substrate manufacture.

[0002]

[Description of the Prior Art] In the field of liquid crystal panel manufacture, electrification of a glass substrate has been a big problem. Especially in these days when enlargement of a substrate and detailed-ization of a component progress, the homogeneity of a glass large-sized substrate and the high-speed electric discharge approach are searched for.

[0003] In manufacture of a liquid crystal panel, in order to carry out orientation of the liquid crystal, there is rubbing down stream processing which rubs a glass substrate with cloth (buff), but since size is insulation greatly, a processing substrate carries out sparse electrification of the high potential. For example, the glass substrate (Fusion 7059) by Corning, Inc. is floated on a 10mm place from a conductor. A front face A cellulose wiper, a rubber glove, absorbent cotton, the roller made from an acrylic, When the amount of 3 round-trip ***** electrifications is measured by each of the roller made from hair, respectively +900--+1500V, - The result called 1000--2000V, -100--200V, +200--+600V, and -1000--1500V is obtained, and also amount to 1kV - 2kV in the magnitude of potential in a high place.

[0004] Thus, if a glass substrate is charged, a suspended particle will adhere according to electrostatic force, or an electrostatic discharge will arise, an open circuit of a component, the short circuit, the vision lack of a picture element, etc. formed on a substrate will be caused, and the yield will be reduced.

[0005] various kinds of Io which used corona discharge conventionally as equipment which discharges an electrification article -- NAIZA is known. various kinds of alternating current system which can make the forward anion concentration to generate balance in JP,3-230499,A concerning the same applicant, JP,3-230500,A, JP,4-106897,A, Japanese Patent Application No. No. 949842 [three to], Japanese Patent Application No. No. 174807 [three to], etc. -- Io -- NAIZA was proposed.

[0006] moreover, Io of the nozzle type which combined the air blowdown nozzle effective in electric discharge and corona discharge pole of the article which is in the closed space and the stagnation region of an air current where this invention persons do not have an air current in air conditioning and sanitary engineering meeting scientific lecture meeting lecture collected works (October 31, Heisei 3 to November 2, Ishikawa) -- NAIZA was announced.

[0007] further -- Io -- by these days, practical use has come [this invention persons proposed covering a discharge electrode with an insulating material, in order to solve the problem said that an electrode deteriorates at the time of discharge of NAIZA, a metal particle disperses and metal contamination takes place, or carrying out the Teflon coat of the counterelectrode, in order to solve the problem of the metallic corrosion produced from the metal exposed surface of a member and] it to be presented as an advantageous electric-discharge facility in a semi-

conductor manufacture process etc.

[0008] the nozzle type proposed previously -- Io -- NAIZA installs the metal discharge electrode covered with the insulating material into the tubed nozzle which has gas blow-off opening at a head, installs the metal counterelectrode covered with resin by the outside of this tubed nozzle, and neutralizes an electrification article. For this reason, the air current injected from nozzle opening serves as the shape of a radiation of a point flare, it is not necessarily suitable for discharging uniformly a large-sized electric discharge article with a large area, since the ion conveyed according to this air current also spreads in a radial, and sufficient electric discharge effectiveness cannot be expected to the liquid crystal substrate with which enlargement progresses.

[0009] In "the neutralization equipment of an electrification article" of Japanese Patent Application No. No. 248552 [four to] which starts the same applicant in order to solve this trouble The supplied-air chamber 104 with [as shown in drawing 12 and drawing 13] slit-like opening for [connecting with the source of a supplied air] curtain air-current formation, It consisted of two or more discharge electrodes 101 for corona discharge connected to the high voltage power supply, and the neutralization equipment of the electrification article characterized by these discharge electrodes being formed successively by this slit-like opening 103 at intervals of predetermined along with the longitudinal direction of a slit was offered.

[0010] With the equipment of this Japanese Patent Application No. No. 248552 [four to], it was going to discharge uniformly the electrification article of the large surface area which has a width of faceful [or] of die length [a little] smaller than this of one side of discharge and this curtain air current for the curtain air current A which contains atmospheric ion I from the slit-like opening 103 of the supplied-air chamber 104. In this method, as shown in drawing 11 , the blowdown air capacity Q is calculated by the product of the slit spacing S of the slit-like opening 103, the slit aperture width W, and the blowdown wind speed U ($Q=S \times W \times U$). Atmospheric ion I generated from near the head of two or more discharge electrodes 101 formed successively by this slit-like opening 103 at intervals of predetermined along with the longitudinal direction of a slit is carried according to an air current, carrying out diffusive mixing of the inside of the curtain air current A, as shown in drawing 11 .

[0011] However, when the dimension of the article for electric discharge is large, in order to acquire sufficient electric discharge effectiveness, a colander was not obtained using sources of a supplied air, such as a certain amount of large-sized blower, but it was a problem. Moreover, with the equipment of Japanese Patent Application No. No. 248552 [four to], the format of the counterelectrode 102 of a discharge electrode was a grid or a ring (you may be a polygon and an ellipse). The thinner possible one of the size of this grid or a ring is desirable in order not to disturb the curtain air current A, but on the other hand it was a problem how this point coming into conflict is solved by there being a limitation in a size from the point of the mechanical strength.

[0012]

[Problem(s) to be Solved by the Invention] Therefore, it is the thing which blowdown air capacity can be reduced substantially, without having made this invention in view of the above troubles, and the 1st object spoiling the electric discharge effectiveness of an electrification article, consequently can cut down a miniaturization and power expense of sources of a supplied air, such as a blower, and for which new and the improved neutralization equipment of an electrification article are offered.

[0013] Another object of this invention is a thing which are excellent in a mechanical strength, disturbs an air current though manufacture is easy and a manufacturing cost is cheap, and does not spoil electric discharge of an electrification article and for which new and the neutralization equipment of an electrification article which has the improved counterelectrode are offered.

[0014] Still more nearly another object of this invention is a thing which the curtain air current containing atmospheric ion is irradiated with single equipment many times at an electrification article, and can raise the electric discharge engine performance and for which new and the neutralization equipment of an electrification article equipped with the improved discharge part are offered.

[0015] Object of this invention another further again is a thing which can change the effective dimension of electric discharge into arbitration according to the dimension of the electrification article which is an object for electric discharge only by adjusting the number of the discharge electrode according to the number of air-current outlets, and it and for which new and the improved neutralization equipment of an electrification article are offered.

[0016]

[Means for Solving the Problem] A supplied-air chamber with [in order to solve the above-mentioned technical problem, according to the 1st viewpoint of this invention, connect with the source of a supplied air, and] slit-like opening for curtain air-current formation, In the neutralization equipment of the electrification article which it consists of two or more discharge electrodes for corona discharge connected to the high voltage power supply, and the discharge electrodes are formed successively by the above-mentioned slit-like opening at intervals of predetermined along with the longitudinal direction of a slit, and changes The above-mentioned opening is divided at intervals of predetermined along with the longitudinal direction of a slit with a spacer, it divides into two or more air-current outlets, and the neutralization equipment of the electrification article characterized by coming to allot each 1 or 2 or more above-mentioned discharge electrodes to each of that air-current outlet, respectively is offered.

[0017] Moreover, a supplied-air chamber with [according to another viewpoint of this invention, connect with the source of a supplied air, and] slit-like opening for curtain air-current formation, In the neutralization equipment of the electrification article which it consists of two or more discharge electrodes for corona discharge connected to the high voltage power supply, and the discharge electrodes are formed successively by the above-mentioned slit-like opening at intervals of predetermined along with the longitudinal direction of a slit, and changes The above-mentioned supplied-air chamber is formed in tubed, and the neutralization equipment of the electrification article characterized by preparing two or more slit-like openings for [above-mentioned] curtain air-current formation in the surroundings of the chamber shaft of the above-mentioned tubed supplied-air chamber at a radial is offered. Also in this case, it is desirable to divide each above-mentioned opening at intervals of predetermined along with the longitudinal direction of a slit with a spacer, to divide into two or more air-current outlets, and to arrange each 1 or 2 or more above-mentioned discharge electrodes in each of that air-current outlet, respectively.

[0018] In addition, it is desirable that the number of the above-mentioned air-current outlets is adjustable according to the dimension of the electrification article which is an object for electric discharge.

[0019] Moreover, each above-mentioned discharge electrode can cover and constitute a metal needlelike electrode from an insulating material. Or each above-mentioned discharge electrode can also be constituted so that an end may be connected to 1 or two or more coat lead wire which were wired in accordance with the chamber shaft in the tubed supplied-air chamber.

[0020] Furthermore, about arrangement of each discharge electrode, each above-mentioned discharge electrode is arranged in the shape of a radiation around the coat lead wire wired in accordance with the chamber shaft in the above-mentioned tubed supplied-air chamber, and the end is connected with the above-mentioned coat lead wire, and it is still more possible to constitute so that it may form successively at intervals of predetermined along with the longitudinal direction of a slit to two or more above-mentioned slit-like openings in which the above-mentioned discharge electrode was prepared by the radial around the chamber shaft. Or it arranges so that it may intersect perpendicularly with two or more coat lead wire wired so that each above-mentioned discharge electrode might come in parallel with a chamber shaft in the above-mentioned tubed supplied-air chamber and discharge electrodes may become parallel mutually, and the end of each discharge electrode is connected with coat lead wire, and the above-mentioned discharge electrode can also be constituted so that it may form successively at intervals of predetermined along with the longitudinal direction of a slit to two or more slit-like openings prepared in the surroundings of a chamber shaft at the radial.

[0021] It is also possible to install the counterelectrode which opened predetermined spacing, and has been arranged from each above-mentioned discharge electrode, and was connected to

touch-down or DC power supply further again, and to attach the counterelectrode in the interior or the exterior of slit-like opening. As a configuration of this counterelectrode, it is possible to consider as a shot, a loop formation, or a hole aperture plate, and it is also possible to cover the above-mentioned counterelectrode with a resin ingredient.

[0022] Moreover, it is desirable to constitute so that the polarity of direct current voltage and magnitude which connect the above-mentioned discharge electrode to an alternating current high voltage power supply, connect the above-mentioned counterelectrode to DC power supply about the power-source connection with the above-mentioned equipment, and are impressed to the above-mentioned counterelectrode can be adjusted.

[0023] Furthermore, it is possible to constitute so that clarification air may be introduced in the above-mentioned supplied-air chamber, the air curtain which the above-mentioned slit-like opening to a blowdown rate is 1 or more m/s, and was ionized by forward or negative may be formed and it may be projected on this air curtain flow by the tabular electrification article.

[0024] As for the neutralization equipment of an electrification article, it is desirable to constitute so that a rear-spring-supporter metal exposure front face may not exist in the whole further again.

[0025]

[Function] In case the regurgitation of the curtain air current is carried out from slit-like opening of a supplied-air chamber, forward or negative ion can be made to emit to the curtain air current uniformly from a discharge electrode according to claim 1. Therefore, this ionized curtain air current can discharge uniformly the electrification article of large surface area with a width of faceful [or] of that of die length [a little] smaller than this of one side. Moreover, since opening area decreases and only a part for a spacer to occupy can reduce air capacity substantially, for example as compared with conventional equipment given in Japanese Patent Application No. No. 248552 [four to] in that case, without spoiling the electric discharge effectiveness of an electrification article, it greatly contributes to a miniaturization and power expense economization of a blower. Furthermore, by pulsation of the phenomenon, i.e., a curtain air current, in which it saw with equipment conventionally which does not have such a spacer, slit-like opening bends, the slit width is changed, and the phenomenon of producing turbulence in a curtain air current can be prevented.

[0026] Since a curtain air current is spouted by the radial from opening arranged at the radial according to claim 2, it reaches far and wide and an electrification article can be discharged. Moreover, by arranging a spacer like the equipment of claim 3 also in this case, while reducing air capacity substantially, turbulence of a curtain air current can be prevented.

[0027] If it depends claim 4, since an electric discharge effective dimension can be changed only by adjusting the number of a discharge electrode according to the dimension of the electrification article which is an object for electric discharge, the electric discharge effectiveness of a line can be raised substantially.

[0028] Also when according to claim 5 covering the metal needlelike electrode with insulating materials, such as quartz glass, and corona discharge is generated, it can avoid that an electrode deteriorates by oxidization or sputtering and particle, such as metal particles, occurs.

[0029] Since according to claim 6 each discharge electrode is attached free [attachment and detachment] while the assembly of equipment becomes easy, according to the dimension of an electrification article, the number of the discharge electrode according to the number of air-current outlets and it can be adjusted easily.

[0030] Since according to claim 7 and claim 8 a discharge part is constituted in the shape of a cluster so that the ionized curtain air current may spout to a radial, it can reach far and wide and a curtain air current can be irradiated to an electrification article. When a supplied-air chamber is arranged so that an electrification article may be horizontally conveyed in the lower part of a supplied-air chamber and a chamber shaft may intersect perpendicularly in the conveyance direction especially Since an electrification article can be discharged according to the curtain air current which contained the atmospheric ion of a head wind to the conveyance direction first and an electrification article can be again discharged according to the curtain air current which contained the atmospheric ion of the delivery style to the conveyance direction

further Many electric discharge can be carried out to an inadequate electrification article by one electric discharge.

[0031] According to claim 9, corona discharge can be efficiently generated by attaching in the interior or the exterior of slit-like opening the counterelectrode which consisted of conductive ingredients, for example. Moreover, if a counterelectrode is made a configuration like claim 10, it excels in a mechanical strength and counterelectrode structure with easy manufacture can be manufactured at cheap cost. Moreover, if the hole is made so that the curtain air current from each outlet can be passed when a spacer divides the hole aperture plate-like counterelectrode of claim 10 into two or more outlets based on this invention, a counterelectrode will not serve as a failure to an air current. Still like claim 11, generating of contamination by the corrosion of a counterelectrode can be prevented by covering a counterelectrode with resin.

[0032] According to claim 12, by adjusting the electrical potential difference impressed to a counterelectrode, the ion concentration of positive/negative can be made to be able to balance and the residual of electrification can be prevented.

[0033] When it rides on a curtain air current and an electrification body irradiates, a cation will adsorb and the ion of positive/negative which is generated by corona discharge according to claim 13 will be neutralized, if the electrification body is just charged, and the anion is charged in negative. It follows, for example, broad large-scale electrification bodies, such as a liquid crystal substrate, are also discharged efficiently, and the electric discharge capacity becomes so high that the wind speed of discharge flow is quick. Moreover, although the class will not be asked as a gas which forms a curtain air current if it is a corona discharge student **** thing, the ease of carrying out of an activity to air is the most convenient. When the particle contained in air adheres to an electric discharge object and poses a problem, clarification air without dust is used.

[0034] According to the equipment of claim 14, all the members for forming curtain air currents including a discharge electrode or a counterelectrode can be constituted so that a surface of metal may not exist. thereby -- Io -- it can prevent that NAIZA itself serves as a source of raising dust of metal particles.

[0035]

[Example] The suitable example of the neutralization equipment of the electrification article constituted based on this invention is explained referring to an accompanying drawing below.

[0036] Drawing 1 - drawing 7 show one example of the neutralization equipment of the electrification article of this invention. The discharge electrode with which, as for 1, alternating voltage is impressed, 20 (2), and 21 are counterelectrodes connected to touch-down or DC power supply. the tubed supplied-air chamber 4 with the slit-like opening 3 for curtain air-current formation -- receiving -- two or more discharge electrodes 1 -- the longitudinal direction of a slit -- meeting -- predetermined spacing **** -- it is made like and connected in the slit-like opening 3.

[0037] In accordance with shaft orientations, the slit-like opening 3 with narrow width of face is formed in the underside of the tubed supplied-air chamber 4 whose cross section which more specifically intersects perpendicularly with a shaft so that drawing 2 may see is a rectangle. On the other hand, the space in a supplied-air chamber from the feed hopper 5 to [forms the feed hopper 5 connected to the source of a supplied air of the supplied-air chamber 4 which is not illustrated in an edge, and / with a perforated plate 6] the slit-like opening 3 is bisected up and down. It is also possible to consider a feed hopper 5 as the configuration of the supplied-air chamber 4 which formed the feed hopper 5 in the upper part of the supplied-air chamber 4 although prepared in the edge on the other hand in the example of a graphic display.

[0038] Since a perforated plate 6 serves as resistance of an air current, the up space 7 in the chamber divided by this perforated plate 6 acts as a charging plenum, it is rectified by the perforated plate 6, the air current S introduced from the feed hopper 5 flows to the lower space 8, and an almost uniform curtain air current carries out the regurgitation crosswise from the slit-like opening 3.

[0039] Furthermore, according to this invention, as shown in drawing 1 and drawing 2 , a spacer 9 is attached in slit-like opening, the outlet 10 of a large number divided by the spacer 9 is

formed, and an unit or two or more discharge electrodes 1 are formed successively at intervals of predetermined along with the longitudinal direction of a slit to each outlet 10.

[0040] Thus, if drawing 6 and drawing 11 are compared by constituting and the slit spacing S and the blowdown wind speed U will assume that it is the same with two equipments so that he can understand easily, according to this invention equipment shown in drawing 6, the blowdown air capacity Q is able to reduce only the surface integrals which a spacer 9 occupies conventionally which is shown in drawing 11 as compared with equipment. In this case, as shown in drawing 6, from each outlet 10 divided by the spacer 9, the curtain air current A of a large number containing atmospheric ion I which carries out the regurgitation is diffused gradually, and is mixed, and it develops into the single curtain air current which hardly changes to the curtain air current shown in ****11 at last. Since it is dependent on the ion total amount per [which reaches an electrification article] unit time amount and the electric discharge effectiveness can reduce the blowdown air capacity Q substantially according to this invention according to this invention, without the electric discharge effectiveness of an electrification article spoiling, a miniaturization and power expense economization of a blower can be aimed at.

[0041] Moreover, in this invention equipment, as shown in drawing 1 and drawing 2, in accordance with shaft orientations, lead wire 11 is stretched and passed in the lower space 8. As for this lead wire, a metallic conductor 13 is inserted into the tube 12 made from Teflon, and the end of each discharge electrode 1 is connected with this metallic conductor 13 free [attachment and detachment] by the holder 18 equipped with the screw 14 with flow relation. that time -- each discharge electrode 1 -- lead wire 11 to the inside of an outlet 10 -- it is arranged so that it may pass along a core mostly, and in the example of a graphic display, the head 15 projects outside a little from opening 3.

[0042] Furthermore, this discharge electrode 1 has covered the needlelike metal electrode (wolfram electrode) 16 with the insulating material 17 thoroughly. The tubular object which consists of quartz glass is used for the insulating material 17. the head where mounting ** and the quartz-glass tubing 17 were closed for the needlelike electrode 16 in concentric circle in the quartz-glass tubing 17 with which the end was more specifically fixed to the holder 18 equipped with the screw 14 -- the point -- it was formed for sharpening and the head of the needlelike electrode 16 is in contact with this point inside.

[0043] The holder 18 penetrated a mounting eclipse and this Teflon tube 12 possible [desorption] through the screw 14 to the Teflon tube 12 of lead wire 11, and the metal electrode 16 inside a discharge electrode has connected it with the metallic conductor 13 inside lead wire.

[0044] Thus, although the discharge electrode 1 of an a large number book opens predetermined spacing and is installed along the die-length direction of a slit, the counterelectrodes 20 and 21 which open a gap from each discharge electrode 1, and are connected to touch-down or DC power supply are attached. When it connects with DC power supply, by adjusting the polarity of direct current voltage and magnitude to impress, the ion concentration of positive/negative is made to balance and the residual of electrification can be prevented.

[0045] As equipment showed to drawing 12 and drawing 13 conventionally, the format of a counterelectrode 2 was a grid or a ring (you may be a polygon and an ellipse). Although the thinner possible one of the size of this grid or a ring was desirable so that a curtain air current might not be disturbed, it is another side and had a problem from the point of that mechanical strength.

[0046] In this point this invention, as shown in drawing 4 and drawing 5, it devised so that a hole 21 (configurations are arbitration, such as a circle, a polygon, and an ellipse) might be made in the location corresponding to each outlet 10 and a counterelectrode 2 might not turn into the counterelectrode 2 which consists of the tabular electrical conducting material 20, for example, a stainless steel plate, with an obstruction to the curtain air current from each outlet 10 in consideration of a mechanical strength, the ease of manufacture, cost, etc. In addition, if drawing 4 of this invention or the counterelectrode configuration of drawing 5 is applied to the single curtain air current formed by conventional Japanese-Patent-Application-No. No. 248552 [four to] equipment, the boundary line parts of a hole and a hole will become a failure to a curtain air

current, and will disturb an air current remarkably, and the electric discharge effectiveness of an electrification article will be spoiled. Therefore, the counterelectrode configuration conventionally shown in equipment at drawing 4 and drawing 5 cannot be fitted.

[0047] Next, referring to drawing 7 and drawing 8, two or more slit-like openings 33 and 43 for curtain air-current formation, and 53 and 63 are prepared in the surroundings of a chamber shaft at a radial at the tubed supplied-air chamber 4, and the structure of the discharge part of a cluster configuration which a curtain air current spouts from a tubed supplied-air chamber at a radial is explained.

[0048] In drawing 7, the surroundings of the coat lead wire 11 wired in accordance with the chamber shaft in the tubed supplied-air chamber 4 and each discharge electrodes 31 or 41 cross at right angles mutually, and it is arranged at equal intervals in a vertical lower part and the direction which makes 45 degrees, and the end is connected with the coat lead wire 11 through holders 35 and 45. Similarly, it intersects perpendicularly with the surroundings of a chamber shaft mutually, and the slit-like openings 33 and 43 prepared in the vertical lower part and the direction which makes 45 degrees form these discharge electrodes successively at intervals of predetermined along with the longitudinal direction of a slit. Furthermore, the up space 7 and the lower space 8 are divided by the perforated plate 6. Moreover, the up space 7 is divided into two space by the separator 38, and it is constituted so that two passage may be formed.

[0049] In drawing 8, it wires so that two coat lead wire 59 and 69 may come in parallel with a chamber shaft in the tubed supplied-air chamber 4, the coat lead wire 59 or 69 which corresponds, respectively, and each discharge electrodes 51 or 61 cross at right angles, and discharge electrodes 51 and 61 are arranged so that it may become parallel mutually. Moreover, the end of each discharge electrode is ***** connected to the coat lead wire 59 and 69 respectively free [attachment and detachment] by the holder 18. Two slit-like openings for curtain air-current formation (53 and 63) are prepared in the supplied-air chamber 4, and a curtain air current intersects perpendicularly mutually and carries out the regurgitation in a vertical lower part and the direction of 45 degree. These discharge electrodes 51 and 61 connected to each of two coat lead wire 59 and 69 are formed successively at intervals of predetermined along with the longitudinal direction of a slit by the slit-like openings 53 and 63 prepared in the surroundings of a chamber shaft two places at the radial. The up space 7 and the lower space 8 are divided by the perforated plate 6 still like the example of drawing 7. Moreover, the up space 7 is divided into two space by the separator 38, and it is constituted so that two passage may be formed.

[0050] The structure of the airstream delivery of the shape of a cluster shown in drawing 7 and drawing 8 omits the explanation by ***** which attaches the sign the same [as the configuration fundamentally explained in relation to drawing 2] and same about the member which demonstrates the same function, except that the slit-like openings 33 and 43, and 53 and 63 are prepared in the surroundings of a chamber shaft at a radial, respectively and discharge electrodes 31 and 41, and 51 and 61 are arranged at each opening.

[0051] In equipment equipped with the curtain air-current discharge part of a cluster configuration as shown in drawing 7 and drawing 8 which were constituted as mentioned above, when a glass substrate is horizontally carried in this supplied-air chamber lower part, a glass substrate is put to the head wind which contained in the beginning the atmospheric ion from a horizontal direction and the direction which makes 45 degrees, and is discharged. Then, this glass substrate is put to the tail wind containing the atmospheric ion from a horizontal direction and the direction which makes 45 degrees, and is discharged once again. Consequently, even if it is a case with once inadequate [electric discharge], it becomes possible to perform sufficient electric discharge by preparing the discharge part of a cluster configuration as shown in drawing 7 and drawing 8, and irradiating the curtain air current which contained a rear spring supporter and atmospheric ion in the electrification article at many times.

[0052] Next, the electric discharge engine performance by the neutralization equipment of the electrification article constituted based on this invention is explained [Japanese Patent Application No. / No. 248552 / four to] in the comparison of the conventional equipment of a publication. The equipment 70 in which the outline is shown performed the comparative study to

drawing 9 . Moreover, drawing 10 is the main configuration equipment for operating the equipment by this invention.

[0053] A glass substrate 71 is placed on the stage 72 made from the silicon resin which is an insulator. With a transporter 73, this stage 72 is moved to a longitudinal direction so that it may overcome directly under charging equipment 79 centering on charging equipment 79. In order to charge the front face of a glass substrate 71 compulsorily, the whole substrate side is uniformly electrified by generating forward or negative atmospheric ion from the discharge bar of charging equipment, and carrying the glass substrate 71 on a stage at the rate of arbitration. The surface potential of a glass substrate changes with the applied voltage to a discharge bar, a haulage rate, and the combination of count of haulage repeat **.

[0054] Below, the main procedures of a performance test are shown.

(1) Electrify a glass substrate 71 compulsorily with charging equipment 79, carrying from left-hand side to right-hand side.

(2) Turn off charging equipment 79 and measure the surface potential on a glass substrate 71 with surface potential 74 [a total of].

(3) Turn on the neutralization equipment (Io NAIZA) 76 constituted based on FFU (fan filter unit) 75 and this invention, and make the yield of forward and negative ion balance using the ion controller 77. It perceives whether the yield of forward and negative ion balanced with the polar bias monitor 78.

(4) Discharge electricity with neutralization equipment (Io NAIZA) 76, carrying a glass substrate 71 from right-hand side to left-hand side.

(5) After a glass substrate 71 passes through the bottom of neutralization equipment 76, turn off neutralization equipment (Io NAIZA) 76 immediately, carry a glass substrate 71 from right-hand side to left-hand side again, and measure the surface potential of the glass substrate 71 after electric discharge with surface potential 74 [a total of].

[0055] Moreover, the Measuring condition of a performance test is as follows.

room temperature: -- 23-degree-C relative humidity: -- 17% - 52% (adjustable)

blow-off mean wind: -- applied-voltage [of 12 m/s charging equipment]: -- **15kV and a direct current (D. C)

Substrate haulage rate: 0.1 m/s (a glass substrate HEION wind is irradiated for 3 seconds)

Glass substrate: Large-sized alkali free glass by Corning, Inc. (Fusion #7059) (300x400x1.1mm3)

[0056] (Example of a comparison) The engine-performance experiment using the neutralization equipment of the conventional electrification article of Japanese Patent Application No. No. 248552 [four to] shown in drawing 11 - drawing 15 as an example of a comparison is explained first. The discharge electrode with which, as for 101, alternating voltage is impressed, and 102 are counterelectrodes connected to a ground or DC power supply. To the tubed supplied-air chamber 104 with the slit-like opening 103 for curtain air-current formation, as two or more discharge electrodes 101 are located in a line at intervals of predetermined along with the longitudinal direction of a slit, they are formed successively in the slit-like opening 103.

[0057] In accordance with shaft orientations, the slit-like opening 103 with narrow width of face is formed in the underside of the tubed supplied-air chamber 104 in which the cross section which more specifically intersects perpendicularly with a shaft so that drawing 13 may see has a rectangle. On the other hand, the space in a supplied-air chamber from the feed hopper 105 to [forms the feed hopper 105 connected to the source of a supplied air in the top face of the supplied-air chamber 104, and / with a perforated plate 106] the slit-like opening 103 is bisected up and down.

[0058] Since a perforated plate 106 serves as resistance of an air current, the up space 107 in the chamber divided by this perforated plate 106 acts as a charging plenum, it is rectified by the perforated plate 106, the air current introduced from the feed hopper 105 flows to the lower space 108, and an almost uniform curtain air current carries out the regurgitation crosswise from the slit-like opening 103.

[0059] In accordance with shaft orientations, lead wire 109 is stretched and passed in this lower space 108. A metallic conductor 111 is inserted into the tube 110 made from Teflon, and, as for this lead wire, the end of each discharge electrode 101 is connected with this metallic conductor

111 with flow relation. this time -- each discharge electrode 101 -- lead wire 109 to the slit-like opening 103 -- it is arranged so that it may pass along a core mostly, and in the example of a graphic display, that head 112 projects outside a little from opening 103.

[0060] Thus, although the discharge electrode 101 of an a large number book opens predetermined spacing and is installed along the die-length direction of a slit, the counterelectrode 102 which opens spacing from each discharge electrode 101, and is connected to touch-down or DC power supply is attached. When it connects with DC power supply, by adjusting the polarity of direct current voltage and magnitude to impress, the ion concentration of positive/negative is made to balance and the residual of electrification can be prevented.

[0061] a counterelectrode 102 is looked at by drawing 14 in the example of drawing 11 - drawing 15 -- as -- the shape of a shot -- having -- **** -- each shot -- the discharge electrode 101 is mostly located in a mid gear.

[0062] All the members of curtain air-current formation of the slit-like opening 103 etc. are constituted from resin (for example, acrylic resin) by the gaseous feed hopper 105 and the tubed supplied-air chamber 104 list. Moreover, a counterelectrode 102 can also be covered with resin. It is avoidable that the counterelectrode 102 which the corrosion of a counterelectrode 102 was prevented by this and corroded by it serves as a source of release of metal particles.

[0063] The slit width of the equipment used for this example is 4mm, and the point of a discharge electrode 101 projects 6mm from the slit-like opening 3. Moreover, the discharge electrode 101 was covered with quartz glass, and 15 installation and a 30mmx30mm grid-like conductor were prepared in the location distant from the point of a discharge electrode 101 10mm as a counterelectrode in 30mm pitch.

[0064] Since the alternating voltage of 11.5kV was impressed to a discharge electrode and forward and negative generating ion concentration were balanced, the direct current voltage of -30--500V was applied to the counterelectrode. Using the clarification air which let the HEPA filter pass into the gas to a supplied-air chamber, the blowdown wind speed of a curtain air current was made into 12 m/s, and as shown in drawing 15, the include angle made with a glass substrate irradiated the curtain air current in the glass substrate side from the direction which is 60 degrees.

[0065] The electric discharge engine performance of equipment in which the large-sized alkali free glass (Fusion #7059) (300x400x1.1mm3) by Corning, Inc. was used for this example as an electrification body for electric discharge was investigated. When, as for drawing 16 and drawing 17, glass is just charged, drawing 18 and drawing 19 are as a result of [when glass is charged in negative] measurement. Only by irradiating the curtain air current containing atmospheric ion for only 3 seconds, electrification (a maximum of 5kV) of the large-sized glass substrate under conveyance (300x400mm2) has been discharged 90% or more uniformly without nonuniformity over the whole surface.

[0066] In addition, the rate of electric discharge was defined as follows. If a is made into the surface potential before electric discharge and b is made into the surface potential after electric discharge, it will become rate of electric discharge $=|a-b|/|a|$.

[0067] The blowdown air capacity Q is calculated by the product of S= 4mm of slit clearances, slit aperture-width =450mm, and blowdown wind-speed U=12 m/s. It was set to Q= 1.3m3/min.

[0068] In addition, when the include angle which a curtain air current accomplishes horizontally was 30 degrees or more, as shown in drawing 20, it became clear by measurement that the rate of electric discharge exceeds 90%. The number of trains in drawing shows the train with the lowest rate of electric discharge among the measurement trains of surface potential forward [of the glass substrate of drawing 21], or negative.

[0069] (This example 1) The equipment of this invention used for the performance test is as being shown in drawing 3 and drawing 4. A point different conventionally which is shown in drawing 11 - drawing 15 from equipment is [0070]. a) Each of 15 discharge electrodes 1 is arranged at 4mmx15mm slit-like opening divided by the spacer 9. Therefore, blowdown opening area of the whole equipment of this example $A=4\text{mm} \times 15\text{mm} \times 15 \text{ piece} =$ it is set to 2 9cm and has become half [of 2] an opening area of 18cm of equipment conventionally which is shown in drawing 11 - drawing 15.

[0071] b) The configuration of a counterelectrode 2 should be the hole aperture lithography 20. It is making a hole with a diameter of 28mm in a stainless plate with a width of face of 40mm 15 pieces at intervals of 30mm, and having made it each of 15 discharge electrodes 1 specifically correspond to it. In addition, spittle 22 is attached and reinforced with the example shown in drawing 3 and drawing 4 at both sides with a width of face [of a counterelectrode 2] of 40mm.

[0072] On the completely same conditions as an invented example, the electric discharge engine performance of the equipment of this example was investigated for the large-sized alkali free glass (Fusion #7059) (300x400x1.1mm³) by Corning, Inc. as an electrification article for electric discharge. The magnitude (a maximum of 5kV) of electrification of the large-sized glass substrate under conveyance (300x400mm²) has been discharged 90% or more uniformly without nonuniformity over the whole surface only by **** irradiating the curtain air current containing atmospheric ion for 3 seconds like drawing 16 showing the electric discharge engine performance of an invented example - drawing 19.

[0073] Here, the blowdown air capacity Q is calculated by the product of 2 and blowdown wind-speed U=12 m/s a blowdown opening area of A= 9cm of the whole equipment. It was set to Q= 0.65m³/min. That is, although the electric discharge engine performance does not have the above-mentioned invented example and ***** straw, the blowdown air capacity of this invention example is reducible in the one half of an invented example, and according to this invention, a miniaturization and power expense economization of a blower can be aimed at.

[0074] (This example 2) The engine-performance experiment to the neutralization equipment of the electrification article equipped with the discharge part of the cluster configuration shown in drawing 7 and drawing 8 below is explained. It has two discharge electrode trains 31 and 41 which consist of 15 discharge electrodes, and 51 and 61 like [equipment / of the example of both drawings] the equipment of an example 1. Each discharge electrode train is arranged like the example 1 of this invention at 4mmx15mm slit-like opening by which each discharge electrode was divided by the spacer, and a counterelectrode is the structure to which make a hole with a diameter of 28mm in a stainless plate with a width of face of 40mm 15 pieces at intervals of 30mm, and it was made for each of 15 discharge electrodes to correspond to it.

[0075] On the completely same conditions as the example 1 of this invention, the electric discharge engine performance of the equipment of this invention example 2 was investigated by using the large-sized alkali free glass (Fusion #7059) (300x400x1.1mm³) by Corning, Inc. as an electric discharge object article. Consequently, the rate of electric discharge of a glass substrate became 99% or more.

[0076] In this example, when a glass substrate is horizontally conveyed in a supplied-air chamber lower part, a glass substrate is put and discharged by a horizontal direction, 45 degrees, and the head wind containing the atmospheric ion from the direction to make at the beginning. Then, this glass substrate is put to the tail wind containing the atmospheric ion from a horizontal direction and the direction which makes 45 degrees, and is discharged once again. In this invention example 1 shown in drawing 3 and drawing 4, the magnitude (a maximum of 5kV) of the electrification has been discharged 90% or more uniformly without nonuniformity over the whole surface only by for only 3 seconds irradiating the curtain air current containing atmospheric ion at the large-sized glass substrate (300x400mm²) of haulage rate 10 cm/s. When the curtain air current containing atmospheric ion is twice irradiated like this example at a glass substrate, since 90% or more per time of electric discharge is repeated twice, also theoretically, 99% or more of electric discharge effectiveness is acquired.

[0077] In addition, since examples 1 and 2 performed electrification clearance for the large-sized glass substrate (300x400mm²), according to the long side dimension of 400mm of a substrate, the discharge electrode of this invention equipment was arranged 15 at intervals of 30mm. That is, a dimension effective in electric discharge of this invention equipment is set to 420mm. However, according to this invention, spacing of 30mm and the blowdown wind speed of a discharge electrode are in a condition as it is, and if only the number of a discharge electrode is changed, a dimension effective in electric discharge of this invention equipment can be doubled with a substrate dimension, and it can change into arbitration. In this case, even if the number of a discharge electrode changed, it was confirmed that the electric discharge effectiveness of the

glass substrate by this invention equipment is not influenced at all.

[0078]

[Effect of the Invention] As explained above, according to this invention, it is possible to be able to reduce blowdown air capacity substantially, without spoiling the electric discharge effectiveness of an electrification article, consequently to cut down a miniaturization and power expense of sources of a supplied air, such as a blower. Moreover, conventionally, though it excels in a mechanical strength as compared with equipment, and manufacture is easy and a manufacturing cost is cheap, the counterelectrode structure of the hole aperture plate of this invention equipment disturbs an air current, and does not spoil electric discharge of an electrification article.

[0079] Moreover, according to equipment equipped with the discharge part of the cluster configuration constituted based on this invention, it is possible to irradiate the curtain air current containing atmospheric ion with single equipment many times at an electrification article, and to raise the electric discharge engine performance.

[0080] Furthermore, according to this invention, it is possible to change the effective dimension of electric discharge into arbitration according to the dimension of the electrification article which is an object for electric discharge only by adjusting the number of a discharge electrode. In that case, it is not necessary to change a blowdown wind speed and discharge electrode spacing.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is the abbreviation sectional view showing one example of this invention equipment.
- [Drawing 2] It is the I-I line view sectional view of the equipment of drawing 1 .
- [Drawing 3] It is the schematic elevation showing one example of this invention equipment.
- [Drawing 4] It is the bottom view of the equipment of drawing 3 .
- [Drawing 5] It is abbreviation sketch drawing of one example of this invention equipment.
- [Drawing 6] It is the explanatory view of the curtain air current formed based on this invention equipment.
- [Drawing 7] It is the abbreviation sectional view showing one example of the cluster configuration discharge part of the equipment constituted based on this invention.
- [Drawing 8] It is the abbreviation sectional view showing still more nearly another example of the cluster configuration discharge part of the equipment constituted based on this invention.
- [Drawing 9] It is the explanatory view showing the main configuration equipment of the equipment for carrying out the performance test of the neutralization equipment of an electrification article.
- [Drawing 10] It is the explanatory view showing the main configuration equipment for operating this invention equipment.
- [Drawing 11] It is the explanatory view of the curtain air current conventionally formed based on equipment.
- [Drawing 12] It is the abbreviation sectional view of equipment conventionally.
- [Drawing 13] It is the II-II line view sectional view of the equipment of drawing 12 .
- [Drawing 14] It is the bottom view of the equipment of drawing 12 .
- [Drawing 15] It is the explanatory view showing the direction of the blowdown of the curtain air current at the time of irradiating an ion wind at a substrate side and the include angle of 60 degrees.
- [Drawing 16] It is the graph which shows the straight polarity electrification potential before the electric discharge at the time of irradiating an ion wind at a substrate side and the include angle of 60 degrees.
- [Drawing 17] It is the graph which shows the straight polarity electrification potential after the electric discharge at the time of irradiating an ion wind at a substrate side and the include angle of 60 degrees.
- [Drawing 18] It is the graph which shows the straight polarity electrification potential before the electric discharge at the time of irradiating an ion wind at a substrate side and the include angle of 60 degrees.
- [Drawing 19] It is the graph which shows the straight polarity electrification potential after the electric discharge at the time of irradiating an ion wind at a substrate side and the include angle of 60 degrees.
- [Drawing 20] It is the graph which shows the relation between the direction of the blowdown of a curtain air current, and the rate of electric discharge.
- [Drawing 21] It is the explanatory view showing the measurement train of the surface potential

of a glass substrate.

[Description of Notations]

- 1 Discharge Electrode
- 2 Counterelectrode
- 3 Slit-like Opening
- 4 Supplied-Air Chamber
- 5 End Connection to Source of Supplied Air
- 6 Perforated Plate
- 7 Up Space
- 8 Lower Space
- 9 Spacer
- 10 Outlet
- 11 Lead Wire of Discharge Electrode
- 15 Discharge Edge of Discharge Electrode
- 17 Quartz-Glass Tubing
- 18 Holder

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

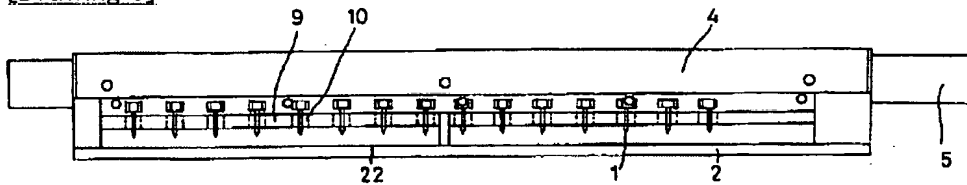
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

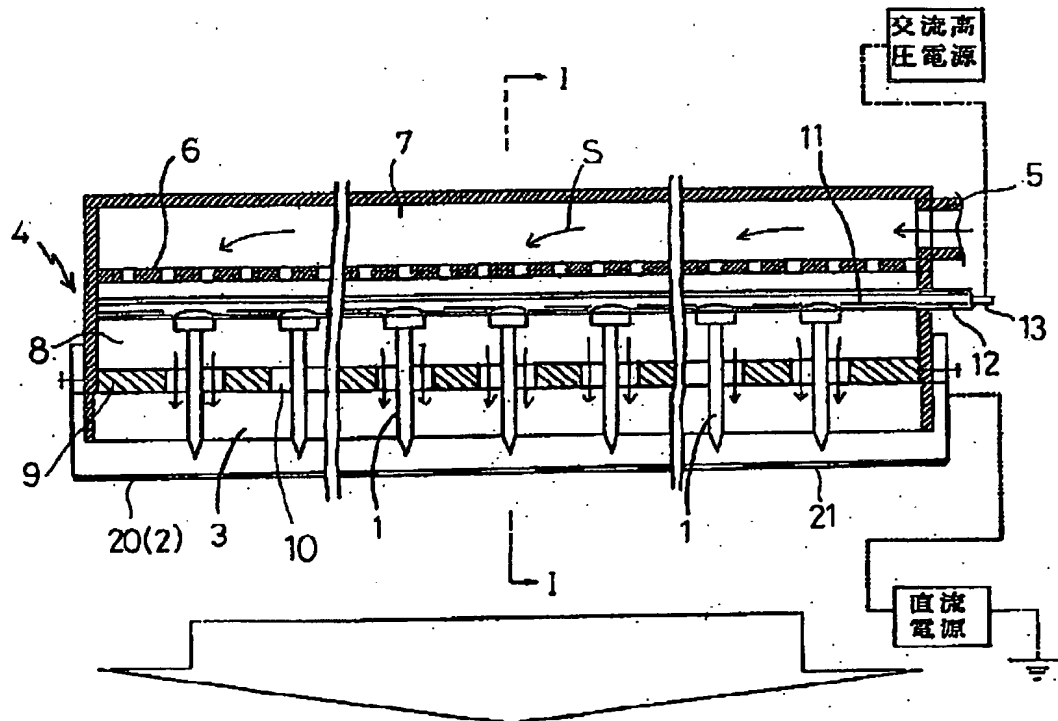
3.In the drawings, any words are not translated.

DRAWINGS

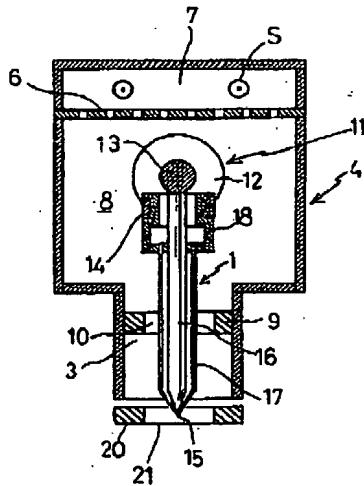
[Drawing 3]



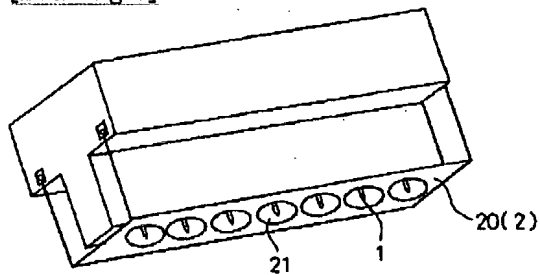
[Drawing 1]



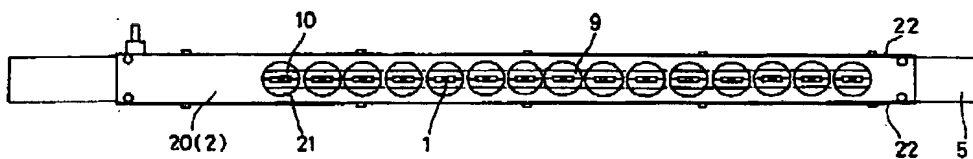
[Drawing 2]



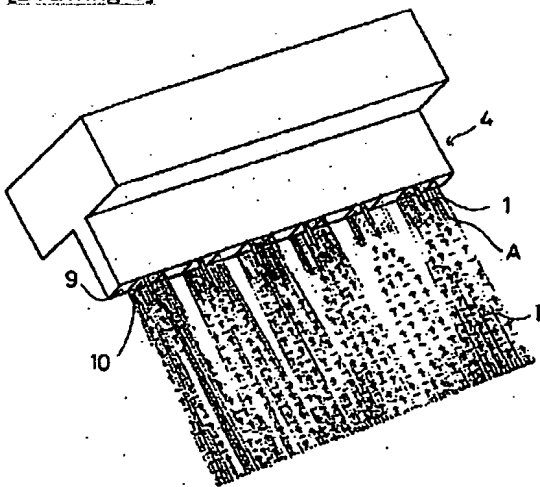
[Drawing 5]



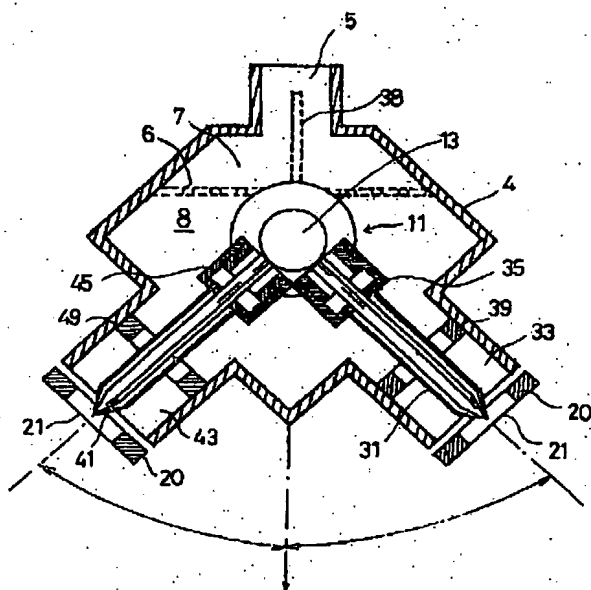
[Drawing 4]



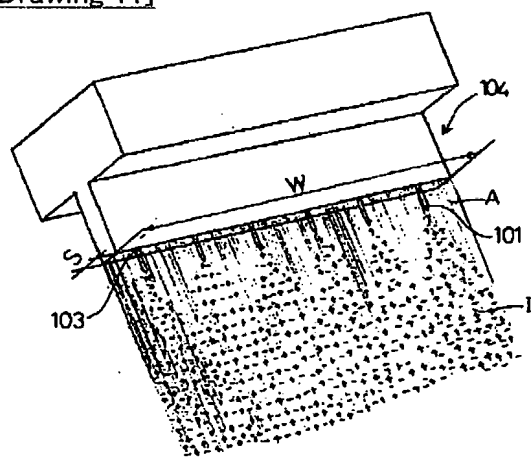
[Drawing 6]



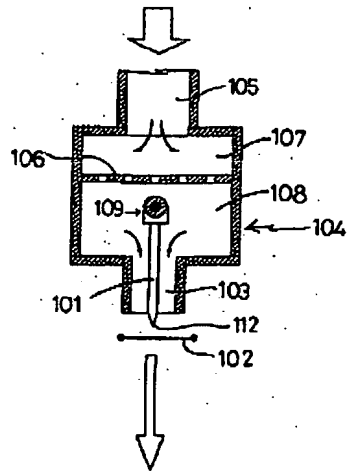
[Drawing 7]



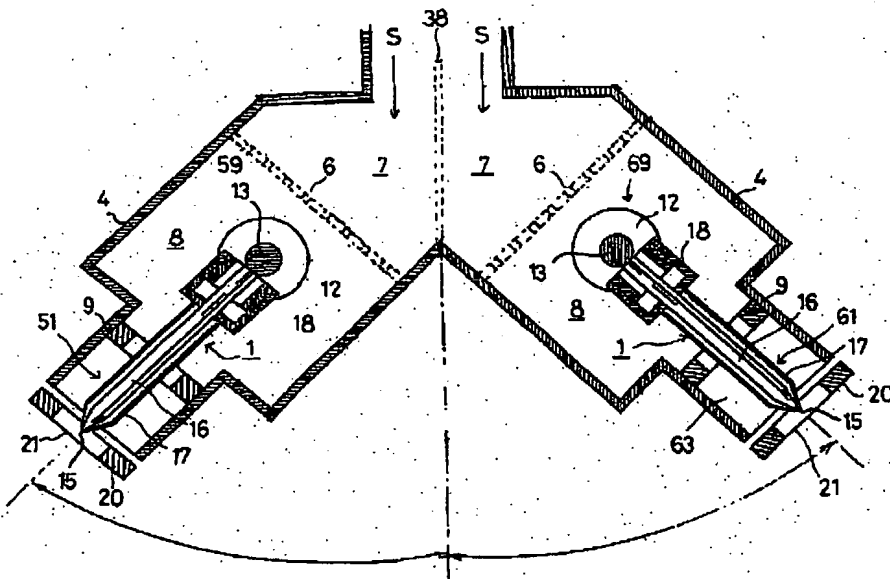
[Drawing 11]



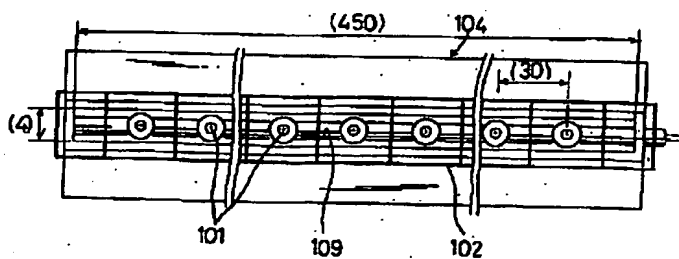
[Drawing 13]



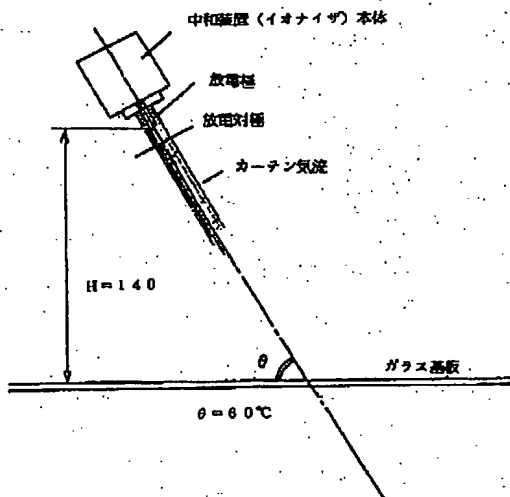
[Drawing 8]



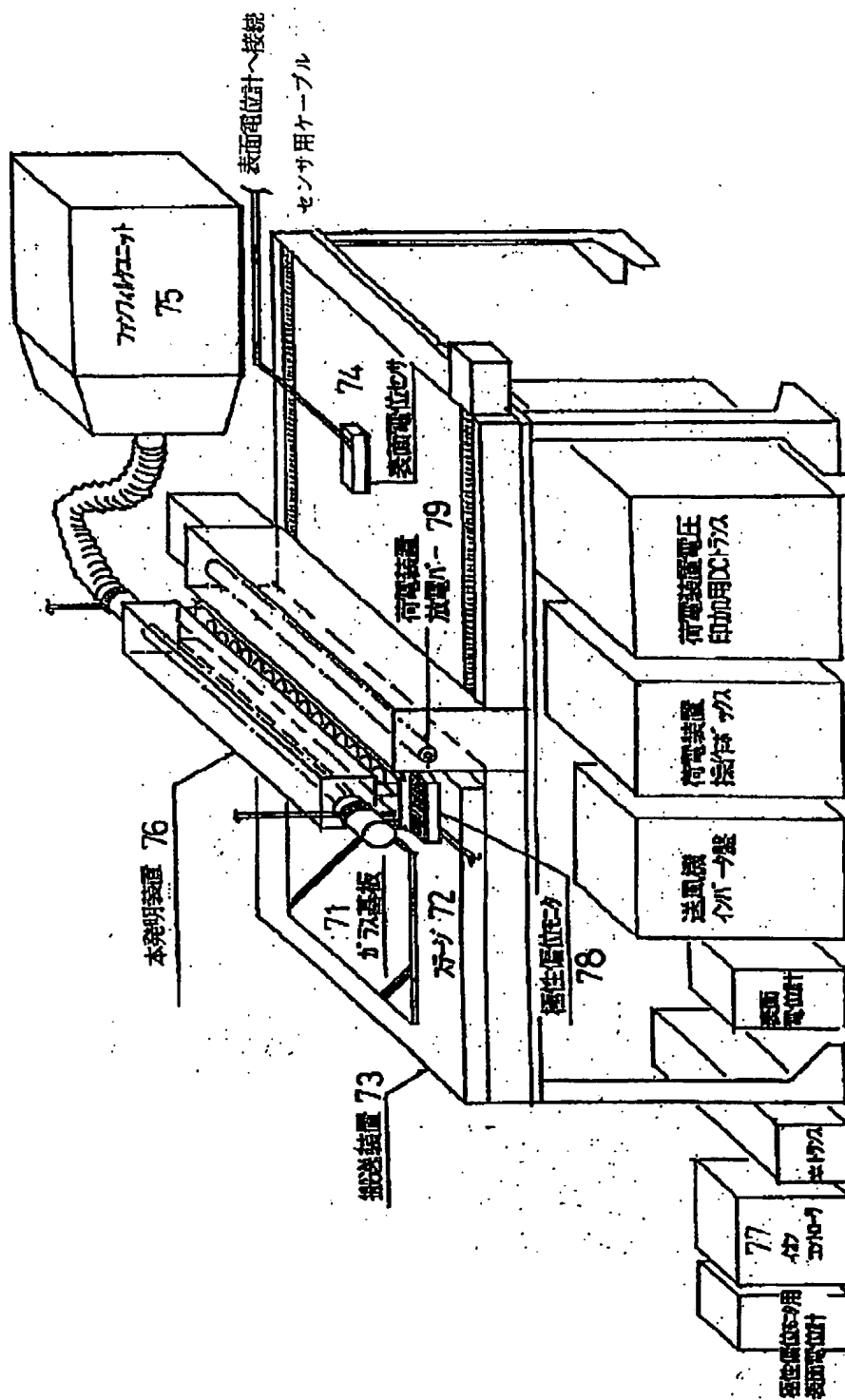
[Drawing 14]



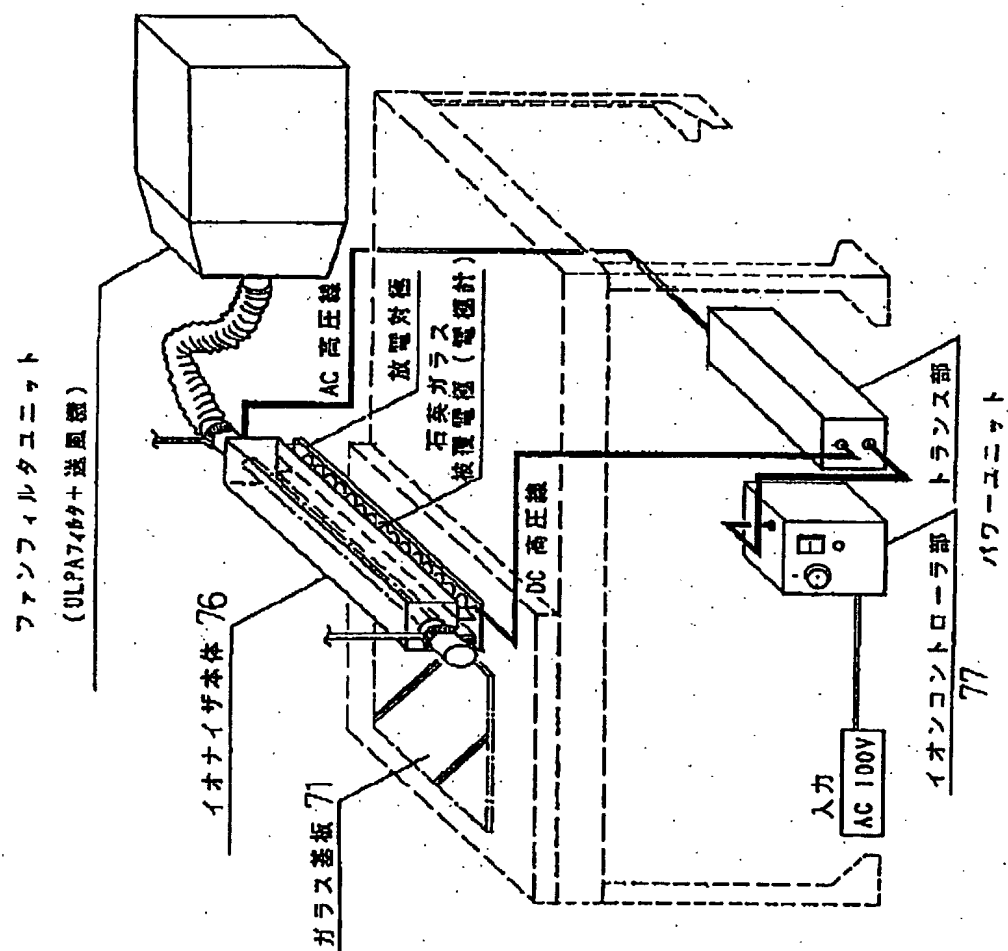
[Drawing 15]



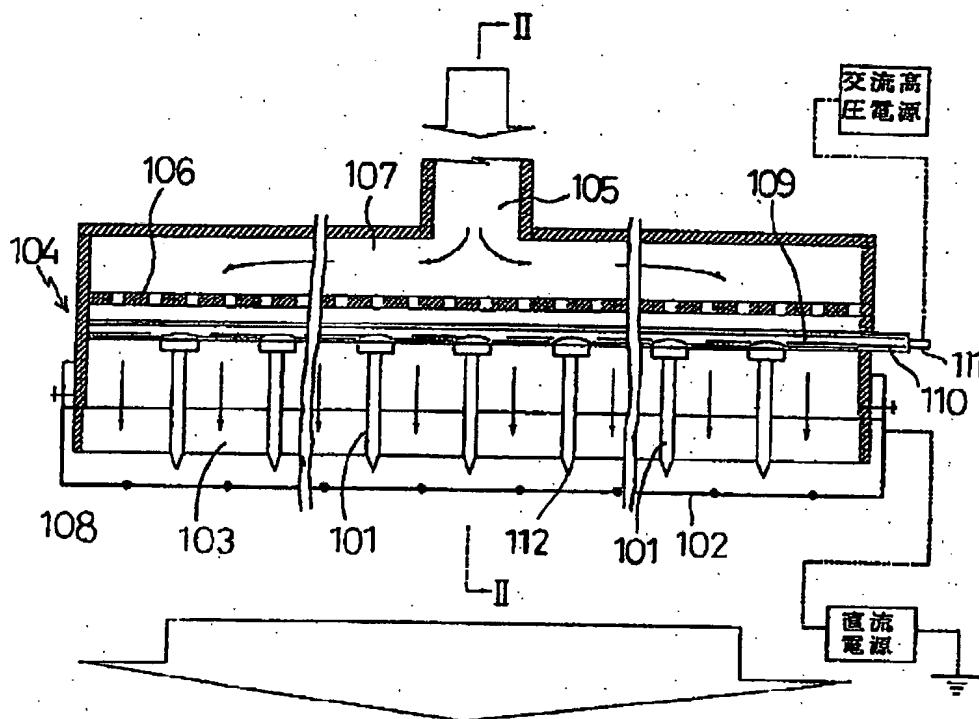
[Drawing 9]



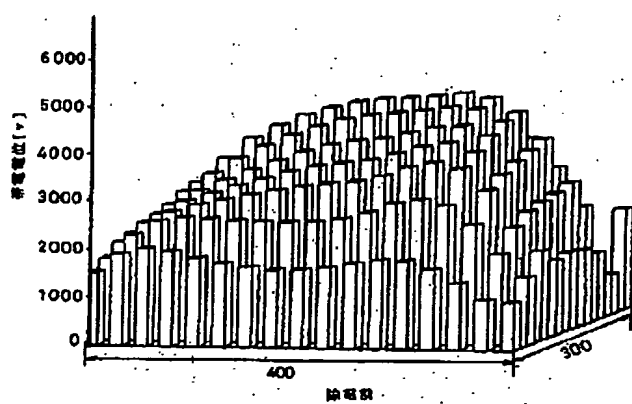
[Drawing 10]



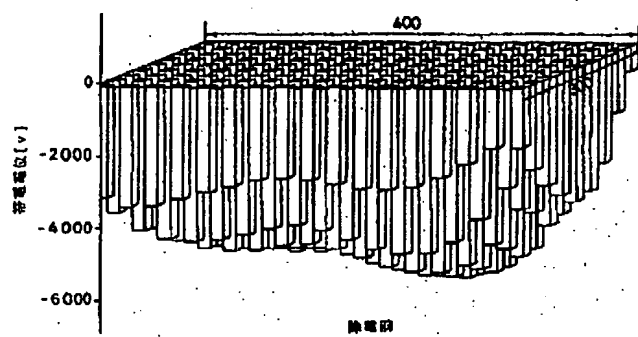
[Drawing 12]



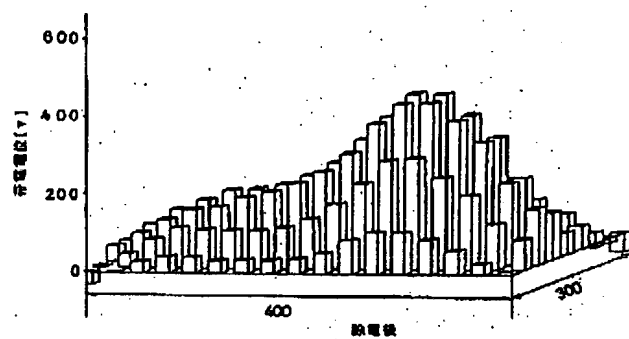
[Drawing 16]



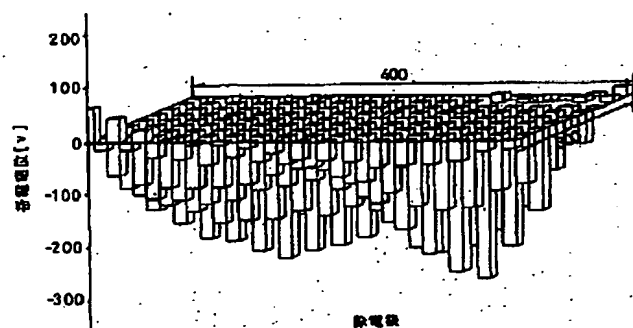
[Drawing 18]



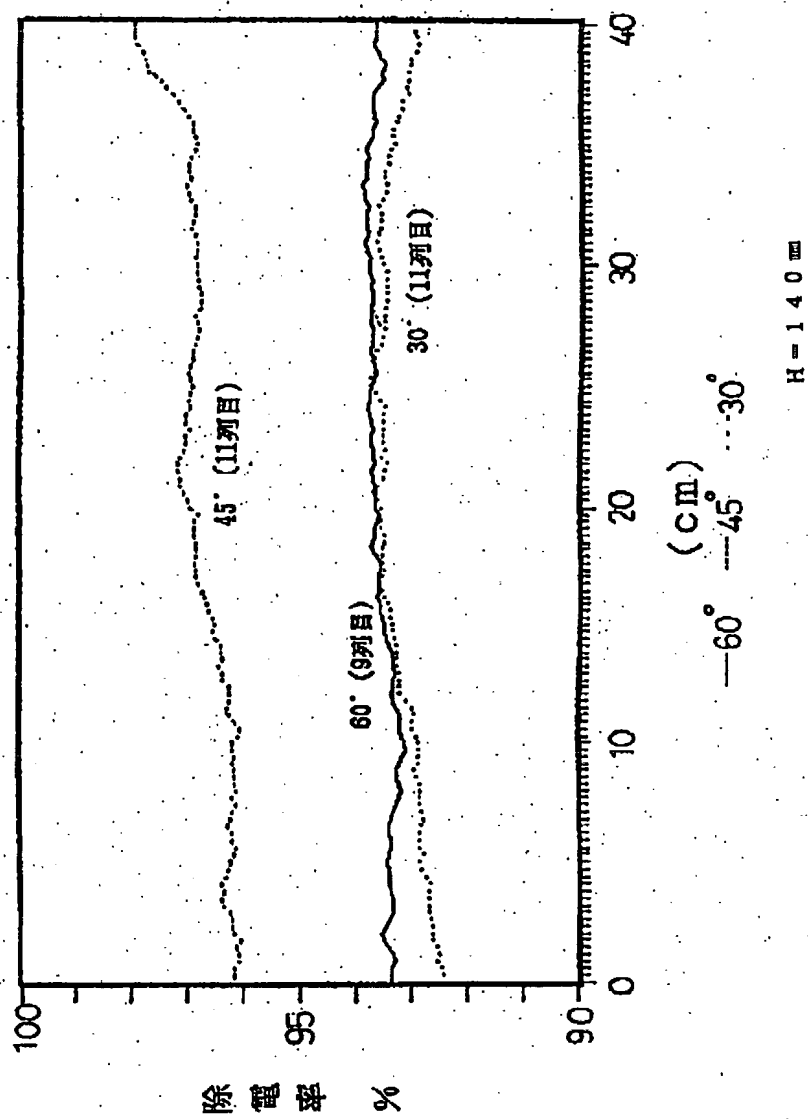
[Drawing 17]



[Drawing 19]



[Drawing 20]



[Drawing 21]

